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A

DESCRIPTION

OF

THE WESTERN ISLANDS

OF

SCOTLAND.

VOL. I.

LONDON:
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A DESCRIPTION OF THE WESTERN ISLANDS OF SCOTLAND,

INCLUDING

THE ISLE OF MAN:

COMPRISING

AN ACCOUNT OF THEIR GEOLOGICAL STRUCTURE;

WITH

REMARKS

ON THEIR

AGRICULTURE, SCENERY, AND ANTIQUITIES.

BY JOHN MACCULLOCH, M. D.

IN THREE VOLUMES.

VOL. I.

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CONTENTS

TO

THE FIRST VOLUME.

Page

INTRODUCTORY Remarks on the general Disposition of the Western Islands 1
Introductory Remarks on the Gneiss Islands 3
Iona 5
Tirey 22
Coll 57
Barra 70
Vatersa. Sandera. Pabba. Muldonich. Mingala. Bernera. 84
Eriska. Fudia. Hellesa. Gia 87
South Uist 91
Benbecula 99
North Uist 118
Rona (West) 152
Harris 154
Taransa. Scarpa. Scalpa 168
Lewis 171
The Flannan Isles 198
Sulisker. North Rona 204
Rona (East) 212
Concluding Remarks on the Gneiss Islands 216

Page
Introductory Remarks on the Trap Islands 235
Rasay 239
Flodda 259
Sky 262
Soa 420
Pabba. Guillemon 422
Longa 424
Scalpa 426
The Shiant Isles 435
Canna 445
Sandy Isle 465
Rum 473
Egg 507
Muck 523
Inch Kenneth 527
Mull 530
Ulva. Gometra. Colonsa. Eorsa 581
The Treshinish Isles 585

PREFACE.

THE following book owes its existence to a collection of papers originally drawn up for the Geological Society. Circumstances, consisting chiefly in their accumulation, induced me to bring the whole into one general view, and to add that which was wanting to render the Work a connected geological account of all the Western islands.

In carrying this design into execution, it became necessary to re-model the greater number of these detached essays; on account of the numerous connexions existing among the several islands, and the frequent repetitions of similar facts which were discovered by thus approximating them under one collective point of view. Many omissions were thus unavoidably made; so that, in a great number of cases, the descriptions of individual islands will appear superficial and imperfect, even where they were originally full. In a topographic view, it would have been desirable to have retained the whole of them entire; but as the chief interest of such details is rather of a general than a local nature, that accuracy would scarcely have compensated for the tedious length and frequent repetitions which would have resulted from such a procedure. It will however be perceived, that the deficiency occurring in one, is supplied in some other island of analogous structure; and it has every where been attempted, so to refer and arrange the several facts, as to enable the reader to supply for himself whatever may be wanting towards a minute account of each; as far at least as they are known to myself.

In thus approximating the islands of analogous structure, for the purpose of rescinding repetitions or superfluities, an attempt has also been made to unite them, as far as possible, into groups regulated by their natural affinities. Thus they mutually assist in explaining the structure of each other; that which is obscure in one, being elucidated by some other of the group; while the interest of the whole is increased by the comparison. To aid the geological reader in deducing from them those general conclusions which are more interesting to him than a naked collection of topographic details, an article is subjoined to each division, in which it is attempted to bring the principal facts into one condensed point of view. By this it is hoped that his progress through the work will be facilitated, and that a small portion at least of that fatigue, which is always the result of a long continued statement of details, will be removed. As it is not however probable that the conclusions of the reader will always coincide with those of the writer, there is still abundant room left for his own reflections.

Lastly, in examining the general relations of the different individuals of each group, it has also been attempted to connect them with the adjoining mainland, wherever it appeared necessary to do so for their illustration; avoiding, as far as possible, any encroachment on such a description of it as can only be the result of future investigations. It is probable that some assistance will thus be afforded to those who may hereafter, with more industry or opportunities, supersede the wish of the author to extend this survey to the Scottish continent.

In approximating the several parts, it became very soon visible that the incessant repetition of mere geological details, would produce a book which would be repulsive to a general reader, and laborious in no common degree, even to a geological one. To relieve this uniformity, as far as was possible consistently with the scale and design of the Work, a variety of matter, of a more miscellaneous and general nature, has therefore been introduced into the account of several of the islands, just as it happened to be found in the writer's journal. The more slender notices of this kind have naturally fallen into the form of notes; and it was no part of the plan to introduce a personal narrative into the description of a country so often visited by travellers. Those travellers have, with various powers and with different success, related much of that which might otherwise have fallen to the lot of the author to describe; but they have not related all, as no one of them has made such wide excursions. That which has already been described, has rarely been touched again, as it could not often have been done better: nor was it a part of this plan to write an universal work on a subject so extensive as the present; including, as it does, matter so various, and so intimately connected with the ancient history and present state of the Highlands of Scotland. If any apology for the scattered position and desultory style of these remarks is necessary, it can only be said that they are introduced just where they arose. To have arranged them in a systematic form, would have led the reader to expect more than was intended, and would have given an air of pretension which the writer is abundantly conscious he could not have justified by a corresponding execution. It must also be remembered that a work may be too long; and that it was necessary to economize the allotted space for that which was the leading object, namely, the geological history of the islands. If the warmth of Caledonian feelings on subjects which relate to Scotland has any where been offended, it would be a source of regret: the writer has himself carried into that country no small share of Caledonian affections, hereditary and acquired; but he has attempted to view these questions with the eye of an unprejudiced "Sassanach."

In the details of the Work, every island which appeared deserving of notice has been described, from North Rona to the Isle of Man. The exceptions that will be found, consist chiefly of the numerous islets which lie on the shores of the Long island, connected principally with North Uist. They presented nothing to require any further notice than that which is given in the map, where their composition is indicated. Every islet, however small, wherever it offered any peculiarity requiring remark, has been introduced. If any apology is deemed necessary for here including the Isle of Man, it must be recollected that it once formed a political part of the Western islands.

With the assistance to be derived from the maps, it is hoped that the account of the geological topography will generally be found as complete as the present state of the geography of these islands permitted. To render such details rigidly correct, requires a degree of geographical accuracy which is not at present attainable, and an extended scale of engravings which the necessary economy of the plan did not permit.

As many of the papers which gave rise to this Work, were drawn up at different and distant periods, and with other views; and as some parts were unavoidably written while the remainder was going through the press, incongruities and repetitions, and probably, contradictions also, will be discovered. On reviewing indeed many parts of it, after four years, I find much that might be altered and much that might be improved. But the fluctuations of opinion, or the increase of knowledge, to which every observer must be subject, are scarcely greater than those by which the science of geology is now almost daily affected. Had the Work been kept to the Horatian period, it would doubtless have required more alterations. Had it been written nine years hence, it might have been even more defective; as the science might have still further outstripped the acquirements of the author.

Whatever may happen in this respect, it is still hoped that the facts will prove useful. As far as they have been carefully investigated, they will assist others in laying the foundation of a more accurate and extended knowledge of this subject: even where these statements shall prove unfounded, they will stimulate future observers, in examining and controverting them, to elicit the truth where it has here been misrepresented or overlooked.

In many instances that have come under review in the examination of these islands, it would have been desirable to have referred to corresponding appearances on the continent of Europe, or in other analogous situations; as such comparisons must have materially increased the general interest of the facts here described. But those countries are unknown to me; and in attempting to compare my own observations with those recorded by authors, I have been unable to satisfy myself respecting their correspondence; partly from uncertainty as to the use of terms, partly from a doubt whether, in many cases, the observations in question were purely practical, and, occasionally, from the broad and abstract mode in which those statements are made, and the rapid and general manner in which the examinations appear to have been conducted.

With respect to the observations of British geologists, I have, for other reasons, rarely been able to derive advantage from them. These have been principally limited to the secondary country of England, while the present relate chiefly to the primary rocks.

Further, as the light under which many of these facts have appeared to myself, has sometimes differed from that in which they have been viewed by others, comparisons of such a nature would have inevitably led to a species of controversial examination which it seemed desirable to avoid, and which would have prolonged the Work without much apparent utility. Where it was impossible to avoid such remarks without leaving the subject in darkness, they have been introduced. I must not however terminate this part of the subject without noticing Professor Jameson's work on the same tract of country. I would willingly have shortened my own labour by being indebted to it, and am glad to bear testimony to the accuracy of his account, as far as the facts have been described. The difference of the plan on which this survey was conducted, rendered it necessary to examine every thing, and deprived me of the assistance which I might otherwise have derived from that work; which includes, moreover, but a small portion of the territory which has here been investigated.

If the following descriptions should sometimes appear unnecessarily minute, and therefore prolix, it must be recollected that a merely topographical account would contribute nothing towards geological science. That science remains yet to be created; and the facts that are to be collected towards it, must be viewed in the manner which our present conjectures as to their eventual utility may suggest as prospectively most conducive towards that leading object. When geological analogies and relations shall become thoroughly understood, a work on mineral topography will be comparatively brief, and may admit of being superficial. It is moreover impossible, in the present state of the science, to foresee the utility of minute research, or the serious deficiencies which may hereafter be found to arise from the neglect of circumstances apparently trifling. The classical naturalists doubtless imagined that they had given descriptions by which the objects of their investigations could be for ever recognised. Our early mineralogists and geologists also, appear to have been satisfied with their own limited accounts of the subjects of their researches. Yet we are hardly able to refer with certainty to one object in the descriptions of the former; and the observations of the latter scarcely enter at present as a constituent into the science. The recent light thrown on geology by the minute circumstances which attend the junctions of different classes of rock and the passage of veins, are too well known to require to be pointed out among the latest improvements in the mode of observation.

It has also been imagined, that from thus minutely detailing some of these appearances, the geological student, to whom practical investigations are yet unknown, may derive rules for his guidance, and, without the formality of instruction, receive hints that may tend to shorten his labour and direct his attention to those circumstances in the history of rocks which appear to be the most important and the most in need of illustration.

I fear the reader will have reason to complain that he cannot here discover any traces of a general theory, nor sufficient references to past theories to guide his steps through the multitude of details. If he should also complain that disorder has been introduced into a system which possesses, at least, a respectable regularity, I can only say that the want of coincidence between the present facts and our systems, cannot be a greater cause of inconvenience to him than it was to myself. The want of a theory to which the observed appearances could be reconciled, proved a constant source of difficulty, and of labour; and the doubts which thence arose respecting their truth, were of a nature to demand frequent comparisons, and repeated examinations.

Such as the facts are, I have however attempted, as far as the plan of the work permitted, to place them in such a light as to render them useful to those who may possess greater inclination or greater power to arrange them under some general theory. If they feel the same difficulties in this respect as myself, they will not be in haste. Wherever the observations disagree with received opinions, I can only trust that the references to the places where they were made, are so precisely detailed that any one may find the means either of verifying or of correcting them. If there are inconsistencies, it is to be hoped that they will be found to lie between the facts and previous opinions: they may often, perhaps, exist in the observations; but they will not be found in Nature. To investigate well is the first duty of a naturalist, and to relate the truth is the duty of all; but every one imagines himself alone to be free of prejudices. There is much yet to be done by those who cultivate this science, but in pursuing his investigations, it is especially necessary for the geologist never to lose sight of the rule of Seneca;

> "Nihil magis præstandum quam ne pecorum ritu sequamur antecedentium gregem, pergentes non quâ cundem est sed quâ itur."

OBSERVATIONS
ON
THE GEOLOGY
OF THE
WESTERN ISLES OF SCOTLAND.

INTRODUCTORY REMARKS ON THE GENERAL DISPOSITION OF THE WESTERN ISLANDS.

For the purpose of rendering the physical description of these islands more intelligible in a topographic view, and more interesting to the geologist in a scientific one, I have divided them into five distinct groups. These are distinguished by the names of the Gneiss, the Trap, the Sandstone, the Schistose, and the Clyde islands*. The four first are associations strictly natural, since a community of structure, with a considerable geographical connexion, pervades each group. The last is founded chiefly on geographical community of position in the islands it includes; although, even in this, certain common characters will be found in a greater or less degree to predominate through the whole. By treating of them in this manner the relations which they bear to the continent of Scotland will be the more readily understood; while from the great length of line they occupy on the western coast, and the analogy of their structure and disposition to those of the continental strata, they will be found to illustrate in a very considerable degree its geological history.

It is impossible to cast our eyes on the map without being struck by the general north-easterly tendency, not only of the western coast, but of the leading vallies and ridges of Scotland. An analogous disposition will be found to prevail in these islands; and the variations, which occasionally amount to a few points on the continental shore, will receive illustration from circumstances that will come under review in giving the details of the individual islands. These bearings of the coast and of the ridges of hills, will be seen, in most cases, to follow the directions of the strata, as will be exemplified in Sky and in many other places; although in a few, as in Bute for example, there is a want of this coincidence. I must here remark generally, that the imperfections of the Map form a source of occasional error and render it difficult to ascertain the general bearings, whether of the land or the strata; a defect which there is no immediate prospect of removing. Examples in illustration of this remark will occur in the course of the investigation. To what extent the description of these Islands may assist in laying a foundation for determining the general structure of the Highland district, is a question that involves considerations too numerous to admit of a definitive answer. We may expect, that in a certain degree similar rocks will be found on the prolonged bearings of those which have been ascertained; and, as far as my observations have gone, such continuations can be traced over a space, at least sufficient to regulate considerably the plan of any geologist, who shall pursue the investigation of the neighbouring main land *. Causes, too well known to require mention, limit the assistance to be derived from this circumstance; yet, when the Islands shall have been described, it will be seen that a considerable step has been gained, and a point of departure fixed for the future examination of the Highland and mountainous division of Scotland.

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* To these have been added two distinct articles, which could not be included in either division.

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* While this work is passing through the press, I am in the act of verifying the truth of this conjecture, by an extensive examination of the western coast. Sept. 1818.

INTRODUCTORY REMARKS ON THE GNEISS ISLANDS.

The first group, in the order of examination that I have adopted, is that of the Gneiss Islands. The greatest body of this rock occupies the outer chain of the Western Isles, which is so nearly identical from one end to the other, as to admit of little variety in description. The next portion, in point of dimension, forms the chain of Coll and Tirey; while Iona, separated from these by a wide channel, may almost be considered as independent. Rona, and the northern part of Rasay, present a tract equally independent, and far removed from all the others.

The general bearings of these several divisions will be found to conform more or less accurately to the leading lines of the coasts of Scotland, as I have before remarked of the islands in general; subject, at the same time, to that deviation which has been already noticed. Yet it will be seen that I have been unable to determine the actual bearings of the strata in the outer chain, popularly known by the name of the Long Island. I do not, however, hold this to be a reason for assuming the non-existence of such a continuous bearing in its stratification, but should rather consider the directions of the coast lines as sufficient indications of what I have been unable to prove from an examination of the strata. This deficiency may possibly have arisen from my own inattention; but it will at any rate prove, that the observations have not been biassed by theoretic views. I am rather inclined to attribute it to the contortion and displacement of the strata which the gneiss invariably presents wherever I have examined it, throughout the course of that extensive chain. Hence, it becomes impracticable to trace the alignement of the limited portions, which alone are amenable to strict investigation; while it is equally impossible to cast a more extensive view over the whole, from the interrupted nature of the ground, and the evanescence of the indications of bearing, when points, sufficiently distant to admit of their being comprehended on a large scale, are taken.

The contemplation of Coll and Tirey, as well as of Iona, may perhaps confirm this suspicion, and add weight to the opinion, that the forms of the coasts in the Long Island depend on the direction of the strata. In these islands it is often equally impossible to trace the bearings of the gneiss; yet in certain places, where granite veins do not interfere, it will hereafter be seen that the beds are perfectly straight, and that their bearings correspond with the position and leading outlines of the chain. The same circumstance is visible in Iona, where the prevailing straightness of the beds enables us to compare them with the general form of the island. But this conformity, if it be thought not sufficiently established by these arguments, or if it be considered worthy of further confirmation, must be left for the determination of future observers. I shall therefore proceed to describe the several islands in the order which appears most convenient, reserving all general comparisons till each group has been described. This description will be found to comprise all the principal, and even some of the subsidiary islands: those only being omitted which partake of a common character, and present nothing but a repetition of the same appearances.

IONA.*

The historical and antiquarian celebrity of this little island renders it an object of perpetual attraction to the numerous visitors who now annually frequent these regions, so lately almost unknown to any but the natives and those immediately connected with them. Being easy of access, and occupying but little of the time usually allotted to Staffa, the prime object of attraction, it is the resort of all who have, in defiance of the rude seas or still ruder rocks of Mull, penetrated thus far, either in search of the picturesque or for the gratification of general curiosity. Added to this, the descriptions of Cordiner, Pennant, and others, with the remarks of Doctor Johnson, have made its history nearly as familiar as its name; giving it, in fact, an importance to which it possesses no claims, either from the antiquity or extent, the beauty or curiosity, of its architectural remains. In any other situation, the remains of Iona would be consigned to neglect and oblivion; but connected as they are with an age distinguished for the ferocity of its manners and its independence of regular government, standing a solitary monument of religion and literature, such as religion and literature then were, the mind imperceptibly recurs to the time when this island was the "light of the western world," "a gem in the ocean;" and is led to contemplate with veneration its silent and ruined structures. Even at a distance, the aspect of the Cathedral, insignificant as its dimensions are, produces a strong feeling of delight in him, who, long coasting the rugged and barren rocks of Mull, or buffetted by turbulent waves, beholds its tower first rising out of the deep; giving to this desolate region an air of civilization, and recalling the consciousness of that human society, which, presenting elsewhere no visible traces, seems to have abandoned these rocky shores to the cormorant and the seagull.

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* See the Map of Mull.

This island is about three miles in length, and one in breadth, being placed nearly in a north-easterly direction. Its eastern coast is separated from Mull by a narrow sound, which, although obstructed by a partial shoal, affords passage with a leading wind to large ships navigating these seas. The western side is beset with numerous small islands and rocks: many are also scattered about its northern and southern extremities, near the latter of which the green island of Soa stretches to sea at a considerable distance.

The surface of Iona is low, rising into numerous irregular elevations, which seldom exceed 100 feet. Its highest hill may be about 400, and is situated at the northern extremity of the island. The coast is, for the most part, indented by small rocky bays divided by similar promontories; but at the north-western side it presents one large plain terminating in a flat shore of sand chiefly composed of broken shells. Another sandy and low plain to the east, contains the ancient remains and the modern village. This plain is but of small extent, and the soil, although arable, is of a light and sandy quality, applicable almost only, and that by the assistance of sea weed, to the cultivation of barley and potatoes. A small quantity of rye is grown; but oats, as in similar soils elsewhere, do not succeed. The upland is a checquered mixture of rocks and pasture, generally moorish, displaying, towards its northern end, a mere labyrinth of rocks, among which it is difficult to explore a way. A few ridges of corn are occasionally found in this upland where the soil is sandy; but it is chiefly pastured by black cattle; which, together with kelp, grown on the shores, and fish, in the taking of which the inhabitants display an industry unusual in this country, form the disposable produce of the island. The population amounts to 450, the rent to £.300; and the land is divided into distinct crofts, in the manner now becoming generally prevalent. This division is but recent, Iona, like most of the farms of the Western Islands, having been, till lately, held in run-rig, as it is called, and each farm annually divided by lot. No plan could well have been devised more effectual in preventing the good treatment, as well as the improvement of the soil; every man's interest being thus set in decided opposition to that of the collective farm, and of the landholder. But the practice is fast expiring, as well as the whole system of tacks and subtenantry, with which it was connected. An amelioration in the mode of culture will, to a certain extent, naturally follow: but the consequent relief to the population of these islands can only be temporary. The lapse of time will again, as it is speedily doing, generate a population as redundant as it was under a worse cultivation, and again produce the same poverty and misery; if, indeed, the state of these small tenants can be considered as any thing at present but a perpetual contest with poverty. A far different system must be adopted, before any permanent amelioration in the condition of the people can be effected.

The number of persons above mentioned corresponds to about ninety families; five and a fraction constituting the average of a Highland family[*]. Thus three pounds, or thirteen shillings per individual, becomes the annual rent of a tenement of land, the house having no value: and this, with some fluctuation in different places, will be found to represent pretty nearly the average rent of an individual throughout these islands. But I shall hereafter give a more general account of these subjects, foreseeing that partial details would otherwise be inevitable, and that they would scarcely be intelligible to those to whom the country is not practically known; however brief that account must, from the nature of this work, be made.

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[*] It is, perhaps, superfluous to say, that celibacy is nearly unknown in these islands.

Were I to omit all notice of the antiquities of this island, the blank might appear to result from negligence, or from a want of proper curiosity: yet the subject has been nearly exhausted by numerous writers, and scarcely admits of revival, even for the purpose of relieving the barrenness of that which forms the principal feature of these volumes. It is pleasing, in the meantime, to see the effect which these writings, and the increased diffusion of a regard for the arts, have produced, in exciting a decent attention to the preservation of monuments which may rather be considered as historical, than as works of art. They are no longer degraded to the purposes of stabling for cattle, nor dilapidated for the erection of cottages for the inhabitants.

It is difficult to conjecture whether there are any remains so ancient as the time of St. Columba. If there are any such, they are probably to be found among the monumental stones: and among the crowd of those which are mixed together, of all ages, and in different styles, of which many have also been removed and again replaced for purposes of recent interment, it would be impossible to distinguish those of high antiquity, deficient as they probably are both in sculpture and inscriptions. To search for such remains among the buildings, appears useless; since the state of society in these regions, in the middle of the sixth century when Columba landed, must have rendered the early settlers incapable of erecting permanent works in stone and lime; the use of which was an improvement belonging to much later times. The original abbey, improperly so called, (since the introduction of monastic regimen was long posterior to the time of Columba,) appears to have been built of wattles; a species of structure equally used in South Britain in the common dwellings, as in the earliest religious edifices after the introduction of Christianity, and recorded in the history of the foundation of Glastonbury: a practice from which some antiquaries, following the hints thrown out by Warburton, have attempted to deduce a visionary theory of the origin of Gothic architecture. An imaginary high antiquity has been assigned to the present buildings; no record of the real times of their erection having survived the decree of the Synod of Argyll, which overturned all that a mob of reformers was capable of destroying, and dispersed, together with the library of the monastery, (the object of regrets perhaps much misplaced,) all the writings which could have thrown light on the subject. It is futile to quote the testimony of Boethius, or of any early writer, in competition with the internal evidence derived from the buildings themselves; while Pennant, although aware of the fabulous nature of that testimony, has left the question unexamined, the history of our ecclesiastical architecture not having been an object of general attention at the time his account was written.

If it were possible to draw a permanent and effectual distinction between the earliest specimens of this style of architecture and those which followed the Norman invasion, we should be perhaps justified in referring St. Oran's Chapel, which bears marks of the highest antiquity, to the Saxon age. The smallness of its scale, which is sixty feet by twenty, its general rudeness, and the perpetual repetition of the chevron moulding in the low circular arch that forms the doorway, assimilate it to those buildings in England which have been supposed prior to the eleventh century. But architects are too little satisfied with respect to Saxon buildings, to admit of such a decision: it can only be presumed from the poverty of the style and execution; circumstances which might easily have arisen from the poverty of the monastery, and the peculiar remoteness of its situation. The tombs within, of which one is placed under a canopy of three pointed arches, offer no objection to such a distant origin, as these are all evidently posterior to the building itself.

The Chapel of the Nunnery is, perhaps, the next in order of antiquity, the arches being also round, but without ornaments: and as the whole style of the building partakes of the general plan of the Norman churches before ornaments came into use, and previous to any appearance of the pointed arch or of the other peculiarities which were introduced at a later date, I should be inclined, from internal evidence, to place it beyond the twelfth century.

The structure of St. Mary's Church, which was at the same time the Abbey Church and the Cathedral of the Diocese of the Isles, bespeaks a later origin, and cannot be referred to a date more distant than the early part of the thirteenth century, if it be even of an antiquity so high*. It is in the form of a cross, with a square tower at the intersection, but of small dimensions and executed in a manner which bespeaks both the limited means of the founders, and the inexpertness of the artists; circumstances in general sufficiently visible in a great number of the ecclesiastical remains of Scotland. The length from east to west is about one hundred and twenty feet, and that of the transept about seventy. The tower is about seventy feet in height. This is lighted on two sides; on one by a window, consisting of a plain slab, perforated with quatrefoils; on the other, by a circular light, with spirally-curved mullions, one of the varieties of the Catherine wheel window. The shafts of the pillars in the church are cylindrical and plain, like those of the Norman era. They are surmounted by short capitals, often sculptured with grotesque and ill executed figures, and separated from the shaft by the corded moulding, which in some cases runs also through the walls on the same level. These pillars support ranges of pointed arches, of a curvature intermediate between those of the first and the second styles which characterize the two most beautiful periods of Gothic architecture, their soffits being fluted with plain and somewhat rude mouldings. A second and smaller tier of arches is perforated in the wall above these, sometimes circular, and at others terminating in a sort of trefoil head: a kind of machicolated corbel table surmounts the whole. I need not enumerate the other ornaments or circumstances which are found in this building; the object being to describe these remains only in as far as is necessary for ascertaining the limits of the dates of their erection. The mixture of styles, of which the leading features have thus been given, bespeaks a date near to that here assigned to this building; which is confirmed by innumerable examples in England, where the same mixture prevails and where the real dates have been ascertained. I must nevertheless remark, while on the subject of dates, that the evidence respecting them to be derived from style in the ecclesiastical buildings of Scotland, is far less satisfactory than from similar works* in England, uncertain as that often is; since in the former country specimens occur in styles which had in the latter been then abandoned, even for a century or much more, in favour of more recent systems; as may be proved by the recorded dates. I may quote the Cathedral of Dunkeld as a remarkable example of this fact; nor are the causes difficult to conjecture. From this consideration it is possible that the Cathedral of Iona may be even more modern than the date to which I have referred it: we are certain that it cannot be earlier. It is unnecessary to notice the buildings appertaining to the Nunnery or the Abbey, since they are mere ruins, neither presenting any interest, nor affording any elucidation with respect to their dates. Granite, found on the opposite shore of Mull, gneiss, hornblende slate, and clay slate, the produce of the island itself, enter conjointly into these structures; the roofs having been covered with mica slate, and the carved ornaments of the interior executed in sand-stone, brought, possibly, from Gribon in Mull.

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* It must be observed, however, that this church bears marks of two distinct periods, the earlier part being to the eastward of the tower. It is probable that this end corresponds more nearly in date with the Nunnery chapel than the western one, to which the following remarks are chiefly applicable. Those mixtures of style which have arisen from addition and reparation, are a frequent source of difficulty to antiquaries.

It is impossible, as I have already said, to form any conjecture respecting the unsculptured grave stones, or even about those which are rudely sculptured and bear no inscription. Tradition is on this subject of no value. It is sufficient to remark, that one of the earliest actually bearing a date, is the tomb of Lachlan M'Kinnon, in 1489. That of the Abbot M'Kinnon, which is in the choir of the cathedral, is of 1500; that of the Prioress Anna, of 1511. These inscriptions are in the Saxon character. There are also some traces of inscriptions in the Gaëlic alphabet to be seen, but undated. It is perhaps incumbent on a mineralogist to state, that the Abbot M'Kinnon's tomb is neither formed of black marble, nor basalt, both of which have been asserted by different observers; but of a micaceous schist, with a mixture of hornblende. The botanist must also be told that the Byssus Iolithus does not grow on this tomb, as mentioned by Lightfoot, but on that of the Abbot Kenneth opposite, one of the Mackenzies of Seaforth. The sculptures on the best of these are but indifferent, if we except those that consist of mere tracery; in which we are often at a loss whether most to admire the persevering intricacy of the designs, or the refractory nature of the material in which they have been executed, which is, I believe invariably, mica slate. Swords, ships, and armorial bearings, with ill executed bass reliefs of warriors, form the chief objects of the others. The ships are the most interesting, as serving to give us an idea of the knowledge which these islanders possessed of navigation. The prow and stern are alike, and protracted into long curves upwards, like many of the galleys of the Romans. The latter is furnished with a well constructed rudder, and the rigging consists of a single square sail, placed a midships, the yard being slung in the centre, and furnished with braces aft. There is no appearance of a provision for rowing, nor is there any bowsprit. As the sail is fastened to the yard by four points only, it is probable that these ships, or rather boats, were but of small dimensions*. The occasional addition of the ship on the grave stone, may perhaps suggest the idea, that the persons whom these stones record were not interred on the spot, but that it signified the tomb to be honorary, like the *ἰχρίον* of the Greeks, and erected to the memory of one whose body lay in a foreign land, or was buried in the ocean. The frequent mention in the ancient poetry of this country, of the pleasure which the ghosts of the deceased derived from the contemplation of their own "grey stones," and the "calling on the ghost" to the habitation which was erected for the body, (the *ψυχαγωγία*) present analogies between the Greek and Celtic superstitions on the subject of funerals, which, while they bespeak, like many other circumstances, a common, though distant origin, give a colour to this opinion. Thus also the Romans,

> "Gaudent compositi cineres sua nomina dici—"

and thus Æneas calls on Deiphobus, when he erects his monument on the Rhætean shore.

The number of the tombs here is great; but much disturbance has taken place among them from recent interments; and it is probable, that many also have disappeared in consequence of the progress of agriculture, and the re-edification of cottages. At this moment, no conjecture can be formed respecting the distinct funereal allotments of the Kings of Scotland, Ireland, and Norway;

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* Pl. 30. Fig. 6.

of which we have nevertheless sufficient historical record in the narrative of Dean Monroe. It is not easy to wander among these remains uninfluenced by the recollections they are calculated to excite. He who can here abstract himself from the living objects round him, and abandon his mind to the visions of the past, will long after recur, with feelings of pleasing melancholy, to the few hours which he has spent among the tombs of Iona.

Among other superstitions which have lost their hold on the minds of the people throughout this country, that of the Clach bràth has passed away; yet the boys of the village still supply a stone for every visitor to turn round on its bed; and thus, in the wearing of this typical globe, to contribute his share to the final dissolution of all things.

Many votive chapels seem to have once existed in this sacred ground; but they have entirely disappeared, together with the greater number of the 360 crosses, which it is said once to have possessed, and of which the greatest portion was, probably, also of votive origin. One of these is at present in Campbelltown, in good preservation: it is covered with an ornamental pattern, together with a Latin inscription in the Saxon character. Three only remain at Iona; of which one, entire and uninjured, is formed of a very long and thin slab of mica slate, and covered with ornamental sculptures of very perfect workmanship. The places of a few others which have been removed are still known, but the greater number is said to have been thrown into the sea by the orders of the reforming Synod.

But I must pass from these pursuits to objects of less general interest.

Although the rocks which compose this island appear, on a superficial view, to be nearly identical throughout, and to consist of different varieties of gneiss, they will be found to present many circumstances interesting to the science of geology. It is difficult to reduce their description to geographical order, from the want of names and of a detailed map; but I shall adopt what appears the most intelligible method, and trace them by the line of the coast.

From the Town to beyond the Bay of Martyrs, the prevalent, or perhaps the sole rock, is a very black compact clay slate, which occasionally contains hornblende, and, in some few instances, mica. There is, however, no real micaceous schist, or at least I did not observe it. It has been imagined to exist here, because most of the tombs and crosses are carved in a stone of this kind. It appears rather, that like the sand-stone in the groinings of the arches and the ornamental carvings of the soffits and capitals, it was brought from the main land, where it abounds along a considerable range of the western coast.

Not far below the town and a little before the clay slate terminates, a vein of black basalt is found traversing it; the only instance of this kind which fell in my way throughout the island.

I must now remark, that the opposite coast of Mull consists of a red large-grained granite, which has been much used in building the Cathedral. A few rocks of this substance are found on the neighbouring shore of Iona, below the Bay of Martyrs; one of which approaches so near to it as to be in contact with the schist: they are very evidently continuations of the rock of Mull. The schist at this place puts on a remarkable appearance. Externally, it displays a singular mixture of black and red. On breaking, it is found to be possessed of unusual hardness, the fracture being as acute and cutting as that of siliceous schist. In many places it loses its black colour and becomes grey; in others, it is partially mixed and mottled with red felspar;·which at length increasing in quantity, it appears on the very verge of passing into the granite with which it is so nearly in contact. The sea prevents the actual and exact contact of the two rocks from being very fully examined; else it is probable that a still more perfect series of this transition might be observed. The contact of argillaceous schist with granite is not rare in Scotland; but this is the only instance I have witnessed in which the interference of the latter is of such a nature as to produce the appearance of a real transition from the one to the other rock.

Proceeding southwards along protuberances and cliffs of a substance which holds an intermediate place between clay slate and gneiss, a large mass of rock presents itself in a most conspicuous manner from the almost snowy whiteness of its surface, which is visible from a considerable distance, even at sea. This white colour is found on examination to proceed from the decomposition of felspar, often so far advanced as almost to pass into porcelain clay. The rock itself is an irregular body of 100 feet or more in thickness, and 600 in length. It cannot be called a bed, but appears to be rather a shapeless mass; having the same connexion with the beds of rock in which it is involved, as we usually find in serpentine, and not unfrequently in limestone, in similar situations. It is a compact felspar, having the small splintery fracture and imperfectly translucent appearance at the edges, of a rock sometimes described by the name of hornstone, which is a very frequent base of certain porphyries. It is extremely refractory to the hammer*. In colour it is sometimes of a pure white, but more commonly it is mottled, or stained with various shades of grey and brown: occasionally also it is of a greenish colour.

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* There are few geologists who have not been occasionally foiled in their attempts to break such rocks with the hammers in common use. I can, from long experience, recommend the following shape. It is either spheroidal, or ellipsoidal, the largest diameter in the latter case not exceeding four inches. The weight need not exceed three pounds and a half. It is evident that the centre of gravity, and consequently the whole momentum, will be so directed towards the point of contact, as in almost every position to produce the maximum effect; a circumstance only accident-

Nearly similar in direction, and removed at a very small distance by a few beds of argillaceous schist, is found the well known marble for which Iona has been long celebrated. I should rather say, the place of the marble, as nearly the whole of the bed has been long since removed. Portions of the walls, and those parts which were inaccessible to the quarry-men by reason of the sea, still remain to show what it has been. It is not a regular bed, since it terminates abruptly at a short distance from the sea, but is rather one of those isolated masses which are of frequent occurrence in many of the schistose rocks, as well as in gneiss. It is from twenty to thirty feet in breadth, and is elevated at an angle of 80 or 85 degrees, dipping to the eastward and directed towards the south, not above 100 yards of its length being visible. All the useful parts have been wrought out, and, it is said, but without sufficient foundation, that the high altar of the cathedral consisted of it. That altar has disappeared, whether in consequence of the superstitious avidity of pilgrims and visitors for its fragments, as report says, cannot now be determined. The texture of this marble is compact, its fracture splintery, and its colour white, often however with a slight greenish tinge. It is incapable of receiving a polish, its aspect remaining either uniformly dull, or as if mottled with

ally occurring in the long bladed prismatic hammer. From the sphericity of the surface, that momentum is also directed on one point, instead of being divided over a large space, as in the flat faced hammer, thus producing that vibration by which rocks are split. The relative position of the centre of gravity and the point of impulse, also prevents that injury to the wrist which so often follows a misdirected blow with the long hammer; its lever acting against the operator. To these advantages I may add, durability; the form preventing the steel from flying off, as in the common construction.

streaks and drops of oil. In many places it has a schistose tendency, more particularly where it approaches to the schist in which it lies. Here also it becomes magnesian, and passes by irregular gradations into a steatitical calcareous schist. It contains in some parts distinct leaves of translucent schistose steatite having an appearance and colour much like that of half frozen olive oil. Dark green foliated steatite is also found in it, accompanied by pale yellowish green and by dark green noble serpentine; which, when detached and rounded on the shore, are well known to the visitors of Iona, and have been often mistaken for jade. I observed only one specimen containing asbestos.

At the points of junction with the schist it is partially mixed with and passes into it, as the limestones which lie in mica slate are known to do, by a sort of alternating gradation. But it presents also a phenomenon scarcely to be expected here; a contortion, by which it is irregularly drawn out, and waved together with the accompanying schist; the parts being involved and entangled in a confused manner*. As the beds of gneiss have all suffered contortion and derangement, there is, however, no reason why the accompanying limestone should be exempt, be the cause what it may†.

The beds of rock which succeed in proceeding northward, appear to be generally placed in a vertical direction, but in a very irregular manner and with very little semblance of a direct continuity. Those hitherto described are either argillaceous schist, or contain that substance as a leading ingredient; but at this point the siliceous matter becomes predominant, or, at least, very conspicuous. These rocks have frequently the external aspect of granite, and have been mistaken for granite veins, which on a distant view they resemble. The granitic ingredient is a compact mixture of felspar and quartz, which is either disposed in laminæ in the schist, or is mixed with it in an irregular manner. Thus the rock resembles a gneiss, though it consists, in strictness, of a laminated mixture of granite and clay slate. It alternates, as far as alternation can be pronounced of rocks so irregular, with the hard argillaceous schist.

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* Pl. II. fig. 5.

† In the posthumous papers of the late Doctor Walker, it is said, that green serpentine is found on the shore at the south side of Iona, and that it may be quarried to any extent. Though prepared to look for it I did not find any other serpentine but that which is contained in the marble. Had it been small in quantity, I might perhaps have overlooked it; as among a wilderness of grey rocks of which the external aspect is alike, it is scarcely possible to examine the composition of every portion; but I can hardly conceive that any extensive rocks of this nature can exist here. I am more inclined to imagine some error in the statement.

This rock is therefore either unprovided with a name, or else it must be considered as a variety of gneiss. If so, both the geological position and the definition of gneiss require to be corrected, since it alternates here with clay slate, and also contains it as an ingredient. Both these circumstances have, in fact, been prematurely limited, and the connexions and definition of this rock, like that of many others, established on too narrow a foundation.

The structure of the remaining part of the island confirms this view of the nature of the rock above described. It may be stated in general terms, as there appears nothing further in its various aspects requiring a minute detail. By degrees the anomalous gneiss gives way to one of a more ordinary structure, consisting of quartz, felspar, and hornblende, disposed in a regularly laminated form, and containing beds both of common hornblende slate, and unlaminated granite; mixtures almost always found to accompany each other in this country in those gneiss rocks of which hornblende forms an ingredient. Still further towards the north end of the island, gneiss containing mica is to be seen, and of this, several varieties, in every possible complication of structure and position, are continued to the extremity of the island.

One peculiarity attends all the rocks of Iona, namely, the great abundance of a substance hitherto considered as compact epidote, which is every where found in them. It is particularly prevalent in that bay, situated towards the west, known by the name of Port na Curachan, where St. Columba is said to have first landed, and which is marked by large conical heaps of pebbles, the penitentiary labours, as tradition says, of pilgrims to his shrine*. It here forms either large lumps or laminæ imbedded in the gneiss, and in some situations enters into it as a constituent part. In other places, it is found mixed with hornblende in various ways, or else serving for a base in which crystals of hornblende are imbedded; forming a rock which has been mistaken for serpentine.

As this substance does not appear to be very common, and seems to have in a great measure escaped attention, a description of its predominant characters will not be superfluous.

It is generally pale green, at times approaching to yellow. The fracture is intermediate between the conchoidal and flat splintery, and it is exceedingly difficult to break, the fragments being slightly translucent on the edges. It does not easily yield to the file, and scratches quartz, while in return it is scratched by that substance. Its specific gravity is the same as that of quartz, but it has not been analyzed. From a comparison of the characters of numerous specimens selected from different places, I am inclined to consider it as a variety of compact felspar, and it will indeed be found to pass occasionally into the more common varieties of that substance. It forms a conspicuous portion of a gneiss abounding on the west coast of Ross-shire.

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* In this spot is found that beautiful and rare Conferva, the atra of Dillwyn; not in streams, but in standing pools.

The gneiss of Iona is by no means abundant in granite veins. A few, however, but those of a small size, may be seen towards the middle and north end of the island. Here the schistus entirely vanishes and the rocks assume the more decided character of gneiss. At the same time, the regular disposition of the beds is much disturbed, or disappears altogether. I observed no other granite in the island than these veins and that rock near the Bay of Martyrs described at the beginning of this sketch.

One porphyry vein may be seen traversing the gneiss in a small bay situated between the marble rock and Port na Curachan. It runs in a S. S. W. direction, dipping about 35 degrees, and is seven feet in thickness. It contains both mica and hornblende, imbedded together with felspar crystals in the common base of compact felspar. If there are any other veins of this description they escaped my observation.

Only one other rock occurred to vary the uniformly tedious recurrence of the gneiss, and this is situated in the interior not far from Bloody Bay. It is a limestone, containing both mica and noble serpentine distributed through it in minute spots, in such quantity as nearly to overpower the calcareous base. It is a stone of extraordinary toughness.

Whatever minerals Iona may still possess concealed among its wearisome rocks, they remain to reward the toils of some future geologist. I shall scarcely visit it again, having fulfilled the Gaelic proverb, which in verse not less rude than the translation, asserts that

> There never yet came man to I[*]
> Who did not come times three.

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[*] I, (κατ' ἐξοχην), the Island, from the religious veneration attached to it. Iona—I-thona; the Island of Waves. I-Columb-kil; the Island of Columba's Cell.

TIREY*.

This island forms, together with Coll, a sort of chain, the general disposition of both being similar, and the mineral composition nearly identical. They may, indeed, in a geological point of view, be almost considered as one object, since their geographical discontinuity is attended with no change in the nature or disposition of their rocks. The sound by which they are separated scarcely exceeds half a mile at its narrowest part; and its depth, which is no where more than six or seven fathoms, is rendered in many places much shallower by interspersed rocks and sand banks. The position of the chain, extending from the southern end of Tirey to the Cairns of Coll, is direct, and on the S.W. by W. rhumb; the total length being 25 miles, or a little more. The shores offer frequent, but not extensive indentations, consisting of sandy bays separated by ridges of rock. They abound in the common fuci, which are manufactured into kelp, and are frequented by the fish usual in these seas, cod, plaice, coal fish, and gurnards; but the fishery forms no regular part of the pursuit of the inhabitants, as it does in many of the other islands.

Tirey is the southernmost of the two, its length being twelve miles, and its greatest mean breadth about four. Its general surface is flat, and so low that it is scarcely elevated twenty feet above the high water mark, affording a free passage to the western winds, which sweep it with unrestrained violence. Having no trees, and scarcely any enclosures to check their force, the gales pass over the island as they do over the sea, materially disturbing the operations of agriculture by dispersing the seed together with the loose and dry soil; and often breaking down the crops both of corn and potatoes when these have attained to their full growth.

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* This name has been a source of difficulty to Gaelic etymologists. Tir, a region, (Gaelic.) Tirim,—dry,—is more appropriate. In the Swedish, Tiur, a bull. Muck, Canna, Soa, and Inish Capel, all offer analogies in favour of this derivation. See the general map.

The southern half of the island is almost an uninterrupted plain, with a few scattered rocky elevations; but towards the northern end the rocks become numerous, and, as in Iona, at length occupy the greater part of the surface, impeding the cultivation of the soil, and condemning it to perpetual pasturage. At the northern extremity there are considerable accumulations of blown sand.

Notwithstanding the general flatness of the surface, Tirey presents three distinct hills near its southern extremity, the highest of which scarcely attains the elevation of 400 feet. A few low hills towards the northern end range from 30 to 60, and would scarcely be noticed in a country less flat than this. It contains two small lakes, one at its southern and the other at its western side, besides some smaller pools; but presents no stream or running water except that which is discharged from one of the lakes and applied to the use of a mill. This want of streams arises from the flatness of the land, as, although the climate is far from wet when compared with the neighbouring high lands, there seldom passes a week in any season of the year without rain. To compensate this defect, water is procured by digging, within a few feet of the surface; and in various parts of the island where there is a want of drainage it is also found producing marshy spots.

The soil is in general light, consisting of sand mixed with peat earth; but the island is remarked for its fertility, forming, in proportion to its extent, one of the most valuable tracts of land in these seas. This fertility is partly the result of the calcareous nature of the sand, which contains, together with quartz, a large proportion of shells, and partly that of the regular and constant moisture which it derives from its climate and exposure, as well as from its flatness. It produces but little peat for fuel, and this forms one of the greatest deductions from its value; the inhabitants being under the necessity of bringing this important article from the opposite coast of Mull. The regular state of moisture in the soil is every where indicated by the Iris pseudacorus, Polygonum viviparum, and other aquatic plants, which are found flourishing in every corn field; little concern being felt, in the Highland system of farming, about the growth of weeds. The natural pastures, which, from their position and soil, are the driest, are surprisingly rich, and produce white clover in such abundance as nearly to exclude the *gramineæ;* that plant being the invariable tenant of all the calcareous soils of the Highlands. A remarkable plain towards the centre of the island is known by the name of the Reef, and comprises a space of 1250 Scottish acres, (1562 English,) as flat as the sea, and scarcely interrupted by a single eminence or even by a stone; offering a singular spectacle of richness and verdure. This plain, from a dread of the effect of the winds should the surface be once broken, is kept in a state of perpetual pasture. In the want of wood, Tirey resembles many of its neighbours, but is even more completely deficient in this article than perhaps any one of them; since, with the exception of the Salix argentea of Smith, (the arenaria of Lightfoot,) it may truly be said not to possess a ligneous fibre.

Tirey suffers but little from the sand inundations, except towards its northern end. There is consequently but little apparent change in the coast line, even on the western side; where, if in any part, the changes from this cause would occur; although, if we are to believe Martin, the Reef was in his day subject to inundation from the sea.

Although the want of shelter in the island may be in many respects injurious to agriculture, yet it is doubtless one of the leading causes of the general fertility of the soil, and of the little injury which results from the sand drift, the effects of which in many of the Western Islands are so conspicuous, and often so injurious. In consequence of its level and unobstructed surface, the sand is distributed by the winds over the flat parts of the island in so equable a manner as to improve the whole by the perpetual renewal of a calcareous manure; while it scarcely any where accumulates to such a degree as to suffocate or repel vegetation. The differences in this respect are very apparent, where the rocky surface, affording local shelter, causes the sand to accumulate, as on the northern end of this island and throughout the whole of Coll; and they will receive further illustration hereafter, when the state of the sandy accumulations on the western shores of the Long Island are described. I may add, that the moisture of Tirey, arising from the causes formerly stated, affords a powerful protection against the blowing away of the soil; by maintaining a perpetual coat of vegetation on the surface, which prevents the wind from acting on it. From these circumstances, the cultivated land of the island is perhaps in many cases less profitable than it would be in pasturage, were it possible to calculate its value on any other agricultural system than that which the extreme population of this island, as of many other parts of the Highlands, renders necessary, or rather indispensable. In consequence of this state of the soil, cross ploughing is rarely used, but the seed being sown on the first furrows, is harrowed in by a light harrow, so that in springing it assumes the appearance of a drilled crop in every respect but cleanness; since the intermediate sod is generally occupied by an equal line of weeds. Under even this miserable proceeding, good crops of barley, oats, potatoes, and flax are produced; sown grass and turnips having here, as in most of the islands, scarcely yet found their way into the agricultural system. The chief manure in use, is that of drift fuci.

As the frequent recurrence of this subject in the different islands might lead to repetitions inconsistent with the principal object of this work, it will be more useful to give a sketch of the agricultural condition of the country in general, reserving for their proper places any peculiarities by which the several islands may differ in practice from each other, and from the system generally prevalent. Without such a sketch, it would be impossible to render remarks of that nature intelligible; on account of the ancient and imperfect practices by which the agriculture of the Western Islands is characterized*. The natural connexion indeed between the soil of any country and its geological structure is, except in the case of some alluvial districts, so intimate, that it is impossible to treat of the geology of a district, without bestowing at least a transient attention on this subject. It would be overrating the advantages of geological knowledge to assert that it can offer much aid to agriculture, yet it may still be a useful auxiliary in certain cases; independently of the pleasure which is always derived by the scientific labourers in any pursuit, from tracing the mutual aid which the several branches of science and art afford each other. To point out all the circumstances in which the study of geology may bear on the pursuits of agriculture, would lead into a length of discussion ill calculated for a work of this nature.

In describing the system of agriculture followed in these islands, I shall confine myself chiefly to the ancient practices, which are still the most prevalent; it would be superfluous to dwell on the recent improvements which have been adopted, corresponding as they do with the more perfect systems in general use. Time is, however, rapidly diminishing the number of these ancient usages, and the progress of improvement is, if slowly, yet certainly, confining them within a smaller circle. When ancient systems are discovered to be prejudices, their downfal is not distant. To make such errors matter of reproach is unjust: they are of all times, and have been accompanied by similar errors in all the branches of human knowledge. The causes by which they are here still maintained are abundantly obvious; and it is rather matter of surprise that so much has been done in a period so short, than that any thing should remain to be accomplished.

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* I shall hereafter merely notice such facts as may occur to illustrate this art, just as they may chance to present themselves in the course of this investigation. Such notices may possibly interest those to whom the country under review is but little known; and they will at any rate serve to enliven a subject not sufficiently various to keep up the attention of the general reader.

Under the ancient system of policy and manners, a scanty and imperfect cultivation of corn was limited to the few spots surrounding villages (if such they might be called) which were immediately under the eyes of the cultivators, and thus more secure from destruction by an enemy: a consideration of importance at a time when every great family was an independent state, and these states were in perpetual hostility. Sheep were, from their habits, ill adapted to the system of pasturage connected with this condition of things, the chief wealth of the inhabitants consisting in cattle; the constant objects of depredation, and the fruitful sources of war. Under such a system, a scanty population with difficulty found a supply of food, and the obvious consequences are too apparent throughout the whole history of the country, to a period even as late as the middle of the last century. The introduction of the potatoe, and the increase of sheep pasturage, made the first material change in the system; and, in consequence of these innovations, the population increased and has continued to increase to this day. But here the improvement may be said to have ceased; at least no radical additions have been made, although modifications of both these great steps, as well as of many parts of the ancient practices, have been introduced, so as to produce in effect changes of great importance. The reader will easily trace in the following details that which has been done, and that which is yet wanting to bring the more antiquated districts to a level with those which have already adopted the improvements of their more enlightened neighbours. The first step in innovation is the most difficult.

The stranger who for the first time visits this country, sees with surprise scanty crops of corn distributed in detached beds of earth which have been collected for its cultivation; or so disposed among a labyrinth of rocks that scarcely an uninterrupted space of half a rood, often of only a few square yards, is to be seen together; while the shortness of the straw and the thinness of the ear, mark the struggles which even this miserable crop has made for existence. He again sees this crop exposed to the storms of August, or drenched in the rains, perhaps for weeks after it has been cut down, and probably laments that human industry should be so far mis-directed; while, like many even of the natives themselves, he will condemn any further attempts to increase or improve this department of rural economy. The prevalence of this opinion among the natives has been one leading cause of the very evil thus lamented; since by tying them down to the ill-conducted practices of their ancestors, it has prevented those improvements in the agricultural department of farming which more experienced observers and more enterprising cultivators have shown to be possible. It will indeed be soon perceived by any observer who will bestow attention on the subject, and abstract the effect of first impressions, that the efforts of art are in this country rarely directed to counteract the injuries or supply the deficiencies of nature; that it too often co-operates with them, and that, under a system adapted to the wants and peculiarities of the climate and soil, of which the severity and defects are too often overrated, improvements of a radical nature and a considerable extension of the present system may be effected. As far as climate is concerned, earlier as well as better crops will be the result of improvements in the methods of tillage; and the harvest, of which the uncertainty chiefly depends on its lateness, will be ready at a better season. A further effect also of an improvement in the system, would be a more regular occupation throughout the year; of which a great portion is now spent without employment, while at one particular season its whole accumulated labours are pressing on the farmer for attention. The introduction of green crops, for example, a necessary part of the improved or convertible system, would tend to divide the occupations of the year, and at the same time preserve the stock of the farm fit for labour when wanted. Such also is the connexion between pasturage and agriculture, that an increase in the latter will enable the insular farmer to rear a greater number as well as a better breed of cattle and sheep, and to deliver their produce to the market, not only of superior quality, but in better condition.

The ancient system consisted in producing crops of corn, either with or without manure, as that could be procured, from the richest fields; and this practice was continued till the land refused to bear any longer; such grass or weeds as happened to grow on it, were then suffered to accumulate for a series of years, and the same process was repeated in a perpetual rotation. The natural pastures were at the same time grazed by the indigenous cattle, by which they were almost invariably overstocked to such a degree, that numbers died at the end of every winter. Finally, the farms, held in run-rig, or common, were overrun with superfluous horses. Such is still the fundamental part of the present system, where better practices have not been introduced; and these are far from bearing even a tolerable proportion to the whole. Isla, Colonsa, Gigha, Sky, Mull, Coll, Rasay, and a few tracts in the Long Island, exhibit, in fact, almost the only exceptions.

If the details of the tillage be examined, they will be found as defective as the general plan. No winter or autumnal ploughing is used, but this operation is conducted in the spring in a most inefficient and slovenly manner. The traveller who chances not to arrive until the harvest is ready, may be surprised to see so many examples of what he will imagine to be the modern drill husbandry, but will soon discover that the appearance arises from the seed having been sown after one ploughing, as mentioned in Tirey. Thus it is lodged in the furrows, where it is afterwards imperfectly covered by a bad harrow; producing a late crop, yet not a clean one, while the advantages arising from deep ploughing are neglected. Cases indeed occur of soils so light and sandy, as in Tirey and many parts of the Long Island, where neither the ground nor the seed could resist the efforts of the wind, were it thoroughly ploughed. In such cases the interest of the farmer, as well as that of his neighbours, would be to avoid ploughing altogether, and to lay down such fields in grass. But two causes prevent this, the temptation offered by sea weed, and the smallness of farms; which compel the little tenant, who possibly has no other land but a driving sand, to procure a crop of corn from it on the best terms he can; an argument among many which will occur at every step, for a different division, and in many cases for an enlargement of farms.

It would lead into details inconsistent with the object of this sketch, to particularize the defects in harrowing, scarifying, weeding, and other operations connected with ploughing; or to notice the total absence of some, such, for instance, as that of rolling.

The reader must perceive that under the system described, scarcely any notion is entertained of the rotation of crops, or of the advantages to be derived from it. Fallowing is not practised, perhaps it might not often be required. Where potatoes have been planted, either on old ridges or for the bringing in of waste lands, a large quantity of manure is applied; and this serves generally for the crops of corn that are to succeed, although a small quantity is occasionally used with them. Barley thus succeeds to potatoes, while that again is followed by oats for two or three, or even a greater number of years, till the land fairly refuses to yield more. In other cases, the barley is sown with manure, and the oats follow as before. Turnips, pease, beans, grass seeds, and clover, are unknown; and the art of farming is thus at least reduced to a system which it requires but little knowledge to conduct. Not so, however, the expense, which is great in proportion to the imperfection of the modes and the scantiness of the produce. It is no diminution of the expense that it is not found in the farmer's accounts; that his labour and the labour of his family are reckoned as nothing; and that the keep of his useless horses does not enter into his calculation. His want of calculation would be a more appropriate term, since the slightest attention to this subject would show, that the cultivation of a few acres could never repay the expense of four or five horses and as many people, were he even rewarded with a full crop. If it be considered that his crop sometimes does not produce the double of his seed, and that four returns in oats are a good crop, we can scarcely set a sufficient price on his grain, or discover by what means he is enabled to pay any rent for the land on which his industry is thus wasted.

Besides barley and oats, a small quantity of rye is cultivated in some of the sandy islands, since a crop of this grain can be obtained after oats have ceased to grow. These crops are both short and thin.

The species of barley exclusively used is bear, which, from its early ripening and other qualities, is best adapted to the climate; and which seems not to admit of any better substitute, or of any other improvement than that of a more careful selection of the seed. The insular farmer, contrary to the general practice, and from mistaken notions of economy, makes choice of the worst part of his grain for this purpose. The same praise cannot be given to the species of oats which is in most use. This is a small dark grain, commonly called the grey oat, and it is of a most unprofitable nature. Three returns are the average produce of this grain, the aspect of which, when in a state for cutting, is such, that a stranger would often with difficulty believe that any serious designs of that nature were entertained. The seeds, or else the soil, are often so full of the Holcus avenaceus, that many square yards will sometimes occur in a field, not containing one plant of oats in the yard. Notwithstanding the small value of this grain, and the scantiness of the produce, the natives are still strongly attached to it on account of its power of resisting high winds, as it does not lose the little grain which it possesses by shaking. The introduction of a better oat would be among the first, and apparently among the easiest improvements in the agriculture of these islands.

The sickle is invariably used in reaping all grain, although the necessity of expedition in the process of harvesting, arising from the uncertainty of the climate, would suggest the scythe as preferable, wherever the roughness of the surface does not prevent its use.

Great part of the straw is used in thatching, and the thatch being ill applied requires constant renewal, inducing a wasteful expenditure of this scarce and useful article. An additional waste is produced by the process of burning or *graddaning*, as it is called; used in some places for converting the corn quickly into bread. The grain is roasted while in the sheaf, in the flame of the straw, more than a third part of which is thus destroyed: the taste of this bread is agreeable, although its complexion is black; but the practice is now becoming rare. More usually the oats, like the barley, are kiln-dried in the ear and then ground into meal. The quern is now rarely to be seen, as mills have been erected in most of the islands; but it is still to be found in some of the smaller ones, forming a most laborious occupation for the women, on whom this, as well as many other parts of the economy of a highland family, falls. The several sorts of grain are formed into cakes in nearly the same manner, by tempering the meal with water and toasting it before the fire; an operation requiring a perpetually recurring and daily labour. A portion of the barley is sometimes converted into whiskey, and almost always in an illicit manner: but this trade is in a manner engrossed by certain districts, from which others are supplied by means of a fraudulent commerce; the division of labour, but little known in the islands, having found its way into this branch of their rural economy*.

The cultivation of potatoes is practised in these islands to a great extent, and with success; and the effect of it in bettering the condition of the people, and in increasing their numbers, has, as in all other instances, been very great. It is, perhaps, not over-rating the use of this root to say, that it forms more than two-thirds of the food of the people. It was not introduced without difficulty; but such a breach once made in the philosophy of a country is an earnest of the possibility of further improvements when sufficient arguments can be produced in their favour. Such arguments ought to be founded on example and demonstrable success; since these are the only ones which the condition of such a country admits. It is true that there are circumstances which seem at present to be a bar to any innovations, even though fortified with these arguments; and which Time himself, the great innovator, cannot remove till many preparatory inroads on the present system shall have been effected. But the detail of these would lead into economical discussions of wide extent, too wide at least for the brief sketch which I proposed to give.

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* Since this was written, a change of the system of revenue, as it affects the highland distilleries, has been effected by the legislature. It yet remains, however, to be seen what its effects will be, as well on these illicit practices as on the state of agriculture.

The general mode of cultivating potatoes is in lazy-beds, as they are called, the intermediate earth being often removed, even to a great extent, on thin rocky soils or on peat mosses, and large drains being thus left between them. These beds are highly manured, generally with sea-weed, since the greater number of farms, indeed nearly the whole population of the islands, lies near the sea. The sets are dibbled in, and are in general carefully weeded; the care bestowed on this justly favoured crop forming a strong contrast to the prevailing slovenliness of the insular agriculture. Receiving this article when its treatment was well understood, the Highlanders necessarily took with it the rules for its cultivation, and no breach of ancient habits was required.

The beds which I have described are made up either by the spade or the more powerful instrument the *caschrom*, often on the bare rock, and they present a singular spectacle to the lowland or English traveller who for the first time witnesses this mode of culture. He will naturally revolt at what he considers misdirected industry and extravagant expense, not reflecting that the divided nature of the tenures and the superfluity of the population cause this waste of toil, and that such a practice is the necessary consequence of the present state of the country. An advantage at first not contemplated is also the result of this system, namely, the acquisition of much arable land from the waste; since it is by the potatoe culture that the peat mosses are brought into a state of aration. There can be no question respecting the imperfection and expense of such a system of cultivation, abstractedly considered: but the question here, as in many other cases, is not about that which is best, but that which is most suitable to the present state of the country. The enlargement of farms and the conversion of tenants into labourers, or, what will necessarily be the other alternative, the removal of the present population and the introduction of a more able and powerful class of tenantry, must precede the introduction of a cheaper husbandry with respect to this root, namely, the drilling and horse-hoeing system. He who has but an acre to cultivate, must cultivate it with his own hands; he who has no plough, must use a spade. The *caschrom* here mentioned is much used in Sky and in the Long Isle, and is an instrument of considerable efficacy and power: it is rather a plough than a spade, and will perform twice as much work as the latter with the same labour. It is a singular circumstance, that an instrument so simple and so nearly a-kin to the plough, and at the same time of apparently great antiquity, should be limited to this country. No trace of it is to be seen among those drawings, whether Egyptian or Hindoo, which represent the plough in its most simple and original state. It would seem to have been the invention of man where the co-operation of animals in his agricultural labours was unknown. Its advantage in this country over the plough arises from its being applicable to the cultivation of rocky ground where a plough cannot be used, or to that of boggy and soft land where a horse cannot walk. Many districts, now in a high state of cultivation, could not otherwise be tilled; and as long as the present system continues, the *caschrom** will maintain its ground.

As the cultivation of grasses forms no part of the ancient system, the hay of the islands is the produce of natural meadows, and, in many cases, of waste scraps of land, whence it is cut and saved at a great expense of labour and time; while it is also contaminated with rushes and other aquatic plants, the usual inhabitants of such situations. Scarcely any attention, except some feeble attempts towards draining, is bestowed on the meadows; which are left as they were found, to the care of Nature. Hence their produce is deficient both in quantity and value, while the hay being rarely secured sooner than the corn is frequently damaged, and even the total loss of the crop, in consequence of its lateness is not uncommon.

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* Pl. 30. Fig. 4.

The cultivation of flax is carried on, but to an inconsiderable extent; and, as may easily be imagined, not in the best manner. That of hemp is still more limited; indeed it can scarcely be said to exist, since it is only occasionally seen in small patches; the produce being confined to the very limited consumption of the country, in the shape of twine or fishing lines. Whether these two substances may be considered advantageous or otherwise when viewed abstractedly in an agricultural light, the question with respect to these islands is of a different nature. Where the operations of agriculture are carried on, in the manner already described, by a superfluous number of hands, and where much time will consequently at certain portions of the year be unemployed, it must be desirable to invent new modes of occupation, until the division of labour, the sure concomitant of improvement, shall have taken place. The manufacture of these substances for the current wants of the community requires little or no capital; and the produce can always command a ready market; thus holding out employment to those who are inclined to profit by it, and operating as a stimulus to a people whose industry is not dead, but, for want of objects, dormant. The ultimate effects may in other respects be even more advantageous, though less immediately obvious; namely, a taste for occupations different from those of agriculture, which notoriously engross too large a proportion of the Highland population, and a demonstration that the means of living are to be procured by other methods than the possession of land. The present habits of subsisting poorly on the produce of land by an alternation of severe labour and idleness, have no tendency to correct themselves. The forcible establishment of manufactures and of fisheries are projects only for inconsiderate benevolence: it is by the gradual change of opinions and practices, by the presentation of new motives and the creation of new desires, that the state of society must be changed. All that which ought to follow, will proceed in its natural order, without force, without loss, and without disappointment.

The system of pasturage forms the remaining and the chief branch of the rural economy of the islands. It is evident that the high mountain pastures which constitute the principal part of the country, are in a great measure incapable of improvement; but the natives seem unfortunately to have formed the same opinion respecting the lower ones, and thus to have neglected those obvious improvements of enclosing, top-dressing, draining, or laying down to grass after occasional cultivation, by which their value would be so materially increased. The possible improvements of that which may be called waste land, may also be considered as pointing rather to an ameliorated system of pasturage, than to agriculture properly speaking. The chief part of such wastes is moor land, formed principally of a mixed and dry peaty soil, commonly thin, and placed on a bottom of gravel or coarse clay; the produce consisting chiefly of heaths, with several coarse grasses and some mosses. Where these lands approach the sea the growth of such plants is checked, and at last destroyed; a fine green pasture succeeding, which, under proper management, is capable of producing good crops of corn. The shores of the Long Island, wherever the numerous inlets of the sea intersect these moors, show striking examples of the fertilizing powers which the vicinity of the salt water possesses; or else of the influence which it exerts in preventing the growth of bog plants and the consequent generation of peat. The same effects are produced by the application of calcareous manures; under which treatment the useless plants disappear and are succeeded by clover and valuable grasses. An excellent black mould is formed in a few years when cultivation has followed that practice; and this is more particularly the case in those islands where the substratum is of trap. The same effect of converting the moor land into green pasture is produced by turning the surface, while the pasturing of cattle prevents it from returning to its primitive state. The expense is in many cases a serious obstacle to any of these modes of improvement, and in certain situations an insurmountable one; but they are, nevertheless, applicable to many thousands of acres now nearly useless, from which the returns would be both immediate and profitable. Those who have wandered over the brown and bare lands of Lewis, or of Sky, may easily imagine the different aspect these islands would assume were such improvements carried into effect. That they will be effected at some distant day there is no reason to doubt. Under circumstances of equal difficulty, of less knowledge, and as little wealth, have some of the principal pastures and cultivated lands of Britain been rescued from heath and barrenness.

With regard to the improvement of mountain land, the pasturage of sheep appears the only expedient. This is well known to banish heath and improve the natural grasses; and the extension of this practice, which is not yet fully acted on although its value is well understood, will ultimately do all which art will probably ever effect on soils of this description.

The methods of reclaiming peat mosses are, at present, perfectly known, and the experiments of many enlightened cultivators have proved that the profits are sufficiently tempting. If there are obstacles to the further increase of this kind of improvement, they must be sought for, not in want either of knowledge of the means or of conviction of their efficacy, but in those circumstances in the condition of the people, the deficiency of capital, the smallness of the possessions, and the want of secure leases, which in every situation must be impediments to improvement. The introduction of the potatoe system has, even in the hands of the smallest tenants, led to the improvement of much peat land, as I already remarked, for here the reward immediately follows the labour; while the means, as far as to the extent yet tried, are in the hands of every one. He who has made the first step has overcome his inertia, and will easily be induced to make a second if he has the means to make it, and a continuation of the stimulus is held out to him. Much has been already effected in favour of the Highland tenant by the division of farms, which has for the first time given him an interest in his possessions, and has also served to demonstrate to him how much his prosperity is connected with his industry. Under the crofting system much land will yet be reclaimed; but it is plain that nothing short of a greater capital, larger possessions, and longer security, can do much for the lands that are yet in a state of nature. These are the leading wants of the system. It must be added, that there is an obvious want of industry in the character of the small Highland tenants, although much paradoxical and contradictory matter has been brought forward on this subject, by contrasting their apparent indolence, their neglect of the most simple and obvious improvements of their comforts and of their condition, with the activity and perseverance which they occasionally show in other pursuits. As an excuse it may indeed be admitted that there can be no exertion without a motive, no industry without a good to be obtained, or an evil to be shunned. A great part of the indolence of the inhabitants is the consequence of a positive want of occupation; much more of it arises from the absence of wants, from contentment with their present situation. It is not too strong a statement to say, that discontent is the basis of all human improvement; the motive to action without which man would yet have been feeding on acorns and clothing himself in skins. The first step towards the improvement of the country is to excite wants; and this must be the result of local example, or of a freer communication with more enlightened countries and a knowledge of more accumulated comforts. Little of this example exists in the remote islands, in which the want of communication is also, from various circumstances, almost complete. In the vicinity of towns and of the improving countries, the change is palpable and rapid. It would not be difficult to point out means by which its progress could be accelerated in the remote districts; but the discussion would carry me beyond the bounds proposed in this sketch.

It is well known that the rearing of black cattle for exportation forms the basis of the pasturage of the islands. These are almost invariably exported in a lean state, and are generally purchased on the spot by itinerant drovers; the risk and expense of freight making, in many cases, a serious deduction from the value of the animal. No attempts have been made to fatten stock for salting; a plan which, with great probability, might in many of the islands be adopted with advantage. Nor is there any system of dairy farming, further than is required to meet the current demands of the cultivator himself; since neither butter nor cheese can be said to form articles of export. The want of winter food is indeed, from the defects of the agricultural system, an obstacle to these practices; and it is a serious detriment also to the very system of exportation under which their cattle are at present reared. In consequence of it many animals die in winter; and even those which survive are at the return of spring so reduced as to be of far less value, even when made fit for travelling and exportation, than they would be under a better plan of feeding. The cultivation of artificial crops, and a system of enclosure and division, are the obvious and necessary preliminaries to any amelioration in this department of insular farming. The breeds of cattle are small, and do not materially vary in the several islands; except where they have, in the improved ones, experienced recent attention: and it seems generally thought that they are not susceptible of any exchange for the better, nor of any other amelioration than such as may be founded on a good selection of individuals. Compared to the breeding of cattle, that of sheep must be considered as a modern improvement, or an innovation upon the ancient system. Formerly this animal was only reared for domestic consumption; and St. Kilda is now the only island where the ancient breed, supposed to be of Norwegian extraction, is still to be seen retaining exclusive possession of the soil. This wretched race is nearly extirpated every where else, having given way to that variety known by the name of the Tweedale breed; the Cheviot having been as yet but partially introduced, and not being at present expected, from the circumstances of the climate, to gain an extensive footing*. The deficiency of winter food is the principal defect in the sheep farming, as it is in the case of the black cattle; but in both there is a still more serious evil in the management, namely, the overstocking of the farms. This excess in the numbers both of the sheep and cattle is visible almost every where, and its results are such as might be expected. It will naturally subside as joint farms become divided and small ones consolidated by the spreading of improvement; besides that it will gradually cease to be felt as the cultivation of winter food increases. The opinions respecting the propriety of an increase of sheep farming have been unfortunately so much connected with the notions of depopulation and emigration, and with all the ill-founded prejudices which these odious terms scarcely ever fail to produce, that the introduction and extension of this practice have always had to contend with a host of obstacles and difficulties, here, as in every instance where it has first been adopted. The progress of agricultural improvement in England, as well in this case as in other endeavours to change the ancient habits, is only the prototype of that which is here but beginning. It is superfluous to discuss the advantages already derived from sheep farming; the subject is indeed too trite to require notice; but it is proper to remark, that in some of the islands under consideration it is deservedly less an object of attention than in the mountain farms of the main land or of those islands which lie near its shores. The sheep does not bear sea carriage well, and is therefore a commodity of far less easy transport than cattle: fortunately there is not a very large proportion of the Long Island, (the only tract from which the transport of sheep would be difficult,) that would be more advantageously occupied by sheep than it is by cattle.

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* The sheep farmers of Sutherland are now of opinion that this variety is perfectly adapted to the climate of the Highlands, and that its more extended introduction will be an essential improvement of the present system.—*August* 1818.

Few circumstances in the system of Highland farming are more remarkable to a stranger than the enormous number of horses kept; a practice, however, which is fast expiring. It is a moderate statement to say, that there are three times more than are necessary; since there was recently a common farm, even in Sky, possessing forty horses, where the whole work might have been performed with six. Tirey lately contained fifteen hundred, a number probably ten times greater than its real wants, but these have been much reduced by means which however unjustifiable it is unnecessary to detail. Of the causes which have led to this wasteful superfluity, some have been unavoidable; while others, having been the result of bad practices now disappearing, are themselves vanishing without specific remedies. The want of carriage roads, and the transport of peat from the hills and of kelp from the shores, must still, as they have always done, produce a necessity for a greater number of horses than would be required if carts could be used. Their inefficacy for labour arising from their bad condition, and from their want of stature and strength, also add to this necessary number a proportion which would be materially reduced if a better fed and stronger race was adopted. The division of the land into small farms leads here also, as it has every where done, to an unnecessary multiplication of them; the number required on a small tenement being equally capable of doing the work of a larger one. In a greater degree this excess has resulted from the possession of common farms, every joint tenant, from pride or rivalship, thinking it necessary to keep as many horses as possible, whether he has work for them or not. It has arisen in some measure also from the undefined value of land when thus held in common; it seeming seldom to enter into the conception of the small tenant that a given portion of land could feed but a given number of animals, whether held in common or not, and that the diminution of the stock of his useless animals would enable him to increase that of his useful ones. The crofting system, where every man's lot is visible to himself, has tended to facilitate his conception of the value of land, and to make him economize that of which he can now see the extent and powers; and it has thus aided to diminish, in a great measure, this preposterous evil*. The breed of horses in question, however deficient in strength and weight for agriculture, is well known for many useful qualities, and for its adaptation to the climate: those of Tirey were noted for their beauty as well as their small size, but they have been exterminated by the violent means above alluded to. When carefully managed and selected, the Highland horses admit of great improvement; but are injured materially by want of food and shelter, and by other modes of ill treatment. They are sometimes shod on the fore feet, often not at all; yet when habituated to it, will travel without injury over the most stony roads, the feet acquiring an unusual degree of hardness, and justifying, as well as the practices of the ancients, the notion that the shoe may in many cases, and under certain systems of work, be entirely dispensed with. Many of the islands, and among these Tirey and Coll, do not even possess a shoeing smith. There is no regular system of breeding for exportation, unless it be in Isla and Jura; and even in these it is not carried to any extent. A few are taken from Sky and Mull by the Irish, but they seem rather to be the last remains of those which are fast becoming unnecessary for the country; and which, though they may still be propagated for a time till the improvements are fully adopted, will probably soon altogether cease to be produced.

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* The tax on horses kept for pleasure has been sometimes resorted to as an expedient for this purpose; and the mention of such an expedient may, perhaps, amuse the politician of the south, who is unacquainted with the internal policy of the Highlands, if policy it can be called.

Asses and Mules are unknown in these islands, although they would probably be found of use as substitutes for horses, from their greater facility in feeding.

Goats have nearly disappeared; and the few that are yet to be seen appertain generally to wealthy tenants, rather as objects of variety or of amusement than profit.

The neglect of swine appears a radical defect in the farming systems of this country, since the sea shores and the unlimited power of cultivating potatoes would render them a valuable stock. I may also add, that rabbits are absolutely unknown; a neglect which is very striking, since innumerable insular situations, capable of being converted into warrens without expense, would render them objects of profit in the commerce of peltry, as well as a welcome addition to the meagre and limited catalogue of a Highland tenant's food.

There are few things more remarkable to a stranger who has been accustomed to the cottages of the south, than the total want of gardens, or even of any cultivated vegetable beyond the potatoe. It is not an exaggeration, I believe, to say, that there is not a culinary vegetable in the country except in the establishments of the proprietors and principal farmers, nor are even all these exempt from censure for their neglect of this department of rural economy. The facility with which this most simple improvement might be introduced, and its total absence, seem unaccountable: but it is disagreeable to proceed where there is more to censure than to praise; I shall therefore terminate this digression, and return to the geological structure of Tirey.

Taken in a general view, the whole chain of Coll and Tirey may be said to consist of a body of gneiss. But each island offers sufficient varieties to render a more minute description necessary.

I was unable in Tirey to trace any regularity of disposition, or even such an approach to it, as to lay down the probable course of the beds. This may arise in a great measure from the inconsiderable elevations of the rocks above the plain, but it is scarcely visible even in the hills; or if for a small space any line of direction or any inclination of a few beds is traced, at the very next step the order ceases, and the appearance of regularity vanishes.

Considerable masses of naked rock are seen in the small hills above described; but except in one place there is no precipitous face, the general character consisting in summits of detached ridges separated by patches of grass. In the flatter parts of the island similar protuberances are irregularly dispersed all over the soil, seldom exceeding from ten to twenty feet in height. The peculiar external forms of gneiss are obvious throughout the whole country; but the conclusion respecting its universality is not deduced from a general view only, portions having been examined from one extremity of the island to the other. It is possible that some beds of the other rocks which occur in gneiss may have escaped my observation, but this must ever happen, as no length of time would suffice for the fracture and examination of every rock which protrudes over a surface of this nature and extent. Under the gray crust of lichen, which wraps all in one undistinguishable covering, mineralogical treasures may yet be concealed in Tirey as in many other places.

The composition of this gneiss is various, but the varieties are all included in that division of it which also forms Iona. Generally speaking, it is characterized by the presence of hornblende. Mica is more rare; and although it is found even together with the hornblende, it is most generally observed in the vicinity of the granite veins by which the gneiss is traversed. The prevailing composition therefore is hornblende, quartz, and felspar. In some places it is very perfectly foliated, in others it approaches so near to granite, that its nature can only be discovered by a favourable fracture. The quartz occasionally disappears, in which case the rock sometimes puts on an appearance intermediate between gneiss and granite; which gradually passes, by varying into a finer grain, or by the exclusion of more of the felspar, into a simple hornblende schist, or into that mixture of hornblende and felspar which has been called primitive greenstone; in some cases to a mere unfoliated hornblende rock. It is also not uncommon to find in it larger or smaller laminæ, or beds and lumps of hornblende rock. There is no regular progress from the granitic to the schistose beds, but they seem to be every where mixed, without order or arrangement. The varieties in which hornblende predominates appear however more abundant at the southern end of the island, in Ben Hynish and Ben Hinivarr, and the paler ones at the other. In many cases these pale varieties consist almost entirely of felspar, or of felspar and quartz; just so much hornblende entering into them as to give the linear appearance by which in a particular direction gneiss is always to be distinguished, and which forms in these cases its only ground of distinction from granite. Wherever the gneiss is visible, of whatever composition it may be, it is almost always more or less contorted or bent. Very rarely can a few yards together be seen, of which the laminæ are straight as well as parallel. Yet, however disturbed, there is always an indication of the laminar structure in some part or other of the mass.

This gneiss abounds in granite veins, and there is great difficulty in ascertaining their forms. In many cases they obviously run a long and determined course, giving off lateral ramifications, and being accompanied by visible shifts in the continuity of the beds of gneiss which they traverse. In others they present irregular lumps of different sizes, sometimes ramifying, sometimes simple, but still attended with a confusion of the gneiss in which they lie. They are often as abundant as the rock which they traverse; in many cases they even occupy more space, fragments alone of the gneiss appearing among the intricacies of the granite. At times they intersect each other so as even to produce a reticulation of the general surface, their intersections being sometimes attended with the shifting of one of the veins; while at other times they cross each other without any change of direction in either. They differ somewhat in composition, and it is one of their frequent characteristics to contain larger concretions of one or other, or of all their several ingredients, than ordinary massive granite. In other instances, they are of so common a character, that specimens taken from them would not be suspected of having been derived from veins. When the felspar is large it has most usually a glassy aspect; occasionally it is of a brick-red colour, as are also many of the granitic varieties of the gneiss. These redder varieties are most abundant on the west side near Balphetrish, and in the vicinity of Cornag more.

In the gneiss there occurs a singular rock, consisting of quartz with imbedded crystals of felspar: but as it is more common in Coll, I shall delay the description of it for the present. The granite of the veins contains in general the four ingredients, quartz, felspar, mica, and hornblende. Green compact felspar, although much rarer than in Iona, is nevertheless found in it. In the vicinity of Trava bay I also observed the same ingredient entering the gneiss, thus forming a beautiful rock consisting of alternate laminæ of this substance, and of common felspar mixed with hornblende. In one or two places there occurred among the veins specimens worthy of notice for the colours of the felspar and of the quartz which they contained. In one of these the felspar was of a pale indigo blue and of a glassy lustre. In the other the quartz was of a sea green and considerably translucent. In both cases these substances were in small concretions.

The gneiss of Tirey is more remarkable for containing masses of limestone. One of these has long been known by the flesh-coloured marble which it affords; of which a quantity has been exported for the purpose of ornamental architecture since the time when it was first pointed out by Raspe. It is improperly called a bed, as it is only an irregular rock, lying among the gneiss without stratification or continuity. In this respect it resembles the greater number of the primary limestones found in gneiss and in mica slate, and may be considered as a large nodule. There is considerable obscurity attending these detached masses of limestone. Of all the rocks which occur in extended masses, granite, trap, and porphyry, only, are unstratified; while the others possess characters of stratification almost always very unequivocal, although in many cases attended with marks of posterior derangement. It is possible that the masses of limestone thus found in gneiss have once been stratified, and that they have suffered some posterior changes by which the appearances of this disposition have been obliterated. In illustration of this opinion I may point out the state of the white marble of Sky, hereafter described; which, though at present as shapeless as the limestones in question, has been once undoubtedly stratified, since it forms portions of a series of parallel strata containing organic remains. Similar illustrations may be drawn from the nature of the limestone in the Isle of Man, which I have described elsewhere; as well as from many well known rocks of this family, which, although now without the slightest mark of stratification, give indications of their having been originally thus formed, from their containing, like those of Sky, organic fossils.

The nodule of limestone which constitutes the marble of Tirey under review, appears to be an irregular mass of about 100 feet in diameter, and is surrounded on all sides by gneiss. The contact is always very definite, yet the quartz seems to be the substance most generally in union with the limestone. Notwithstanding this defined contact, it occasionally contains imbedded lumps of granite or gneiss similar to those which occur in the limestone of Glen Tilt. These are always visible at the surface, from their superior power of resisting the action of the atmosphere. This limestone is of a reddish hue, varying from a high flesh-colour through pink to nearly white, and from a muddy crimson to a dull purple; often also with a greyish aspect bordering on blue. It is of a very fine splintery fracture and smooth grain, precisely like the marble of Iona. Though no where bedded, nor capable of being raised in parallel-sided masses, yet after exposure to weather it not unfrequently splits into thin laminæ with great facility, marking a structure once probably stratified. It contains occasionally large concretions of black and shining hornblende, of two inches or more in length, but is most distinguished by the quantity of augite dispersed through it, to which its beauty, as an ornamental marble, is principally owing. The effect arises from the contrast of the dark green spots with the reddish tone of the ground. In consequence of its hardness it has fallen into disuse, although, even under that inconvenience, it is still cheaper than many foreign marbles of far inferior beauty*. The quarry has been ill wrought, and indeed nearly ruined by gunpowder, having been managed apparently by workmen ignorant of the use of the feather-wedge or other modes of raising unstratified rocks. About half of it seems to remain untouched; but much even of that is split by the mines used in detaching the blocks which have been quarried.

Not far from the house of Balphetrish, and in the vicinity of the rock now described, another considerable mass of limestone occurs. It is equally irregular, but of ten times the size of the former, and like that, bounded on all sides by gneiss. It has been quarried, apparently for the sole purpose of building dykes, at least I could not hear that it had been used for, the purposes of ornament. It bears a considerable resemblance to the former in composition, but contains many more varieties of the pyroxene by which that is characterized. The basis of this marble is white. When pure, it is equally snowy in aspect with the marble of Iona, which it also resembles in texture and fracture, except that it has no where a schistose tendency. In most parts, however, it is impure, even where it contains no imbedded mineral; breaking with a large irregular fracture, and showing greenish yellow stains in the natural rifts. This seems to arise from an admixture of serpentine or steatite. The same substance is found dispersed through it, either in small lumps or in minute grains of a dark green or yellowish hue; the specimens differing in no respect from the well known pebbles of similar marble which are found in Iona. This variety is highly ornamental, but there does not appear to be any extent of it applicable to useful purposes. The variety which contains sahlite seems to be considerably more abundant. This mineral is dispersed in the form of small grains, like the coccolite of the pink marble, through a pure white calcareous ground, the crystals being in general thinly disseminated, and of a pale, or light blueish, or dark greenish grey colour. These grains are also at times crowded together in detached lumps of the size of a nut, and from that to the size of an orange, or larger. Where the surfaces have been exposed to the weather they are readily seen; not so much by their own superior permanence, as by that of a nodule of the marble immediately surrounding them, which is always much tougher and harder than the general body of the rock.

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* Such has generally been the public caprice with regard to our native productions that scarcely an ornament exists in Britain of the beautiful serpentine of Portsoy, although in the reigns of James the Fifth and Mary it was wrought and exported to Paris, where specimens of it may now be seen among the interior architecture of many houses.

The last calcareous rock which I observed in Tirey is in Gott Bay. This is a blueish limestone containing much mica, and of a very tough constitution. It forms a nearly vertical set of irregular beds of no great extent, accompanied by gneiss and traversed by granite veins; in which latter circumstance it differs from the calcareous rocks before described. These veins may be traced passing from the gneiss into the limestone. The action of the sea having deeply corroded the upper edges of the beds, has brought to light an intricate contortion which they seem to have undergone. This it has effected by acting on the micaceous laminæ, thus separating the flexuose calcareous strata by deep erosions. There is a great resemblance between the contortions of these beds and those of the limestone of Glen Tilt; and in both cases granite is present. The contortion of beds is a phenomenon of much interest in geology. Although common in the schistose rocks, it is of more rare occurrence in limestone, and therefore worthy of being pointed out wherever it exists. It appears to be so obvious a consequence of the posterior disturbances of beds in a softened state, that it is unnecessary to accumulate arguments on the subject. In Mar, in Glen Tilt, and in this place, it is either accompanied by the presence of granite veins or occurs in the neighbourhood of granite masses. In many cases the disturbances of the schistose rocks also occur under the same circumstances; but there are nevertheless instances every where of great contortions in all these rocks where granite has not been found in the neighbourhood. It would be generalizing without just grounds therefore, to say that the disturbances of these rocks were produced by the vicinity of granite. Many other causes of motion besides the supposed protrusion of granite may have existed among the strata which constitute the surface; but of these our imperfect knowledge prevents us at present from forming any judgment.

The phenomenon in Gott Bay now described is of some importance in the history of gneiss. It has been said that all the granite veins in gneiss are contemporaneous; a term of which the meaning is not always very definite. In this case it is perhaps meant, that the granite vein is a necessary portion of the gneiss; each being formed independently of the other, although in a state of contact and mixture, and the appearance of a vein being merely incidental. But in the rock under consideration the same body of granite which traverses a bed of gneiss, traverses an approximate bed of limestone, without change of direction, continuity, magnitude, or character: a phenomenon possessing on this supposition the highest degree of improbability, and requiring circumstances of which we can form no conception.

I must now proceed to describe at more length the mineral substances contained in the rocks of Tirey; the most conspicuous of which are those at present ranked under the general term of pyroxene. All these, as must already have appeared, are contained in the different limestones; the darker coloured, which possess the characters of augit, being found in the pink limestone, and the several varieties of sahlite in the white.

I have pointed out in different parts of this book the predominance of augit in Rum, in the Shiant isles, in Sky, and in Arran; it occurs also in other places, but always as a constituent of the trap rocks. In Tirey alone, as far as I have observed, it is found in primary limestone. Sahlite is found in a more dispersed manner and in smaller quantities; but it occurs in several places, as in Harris and in Glen Elg, affording different varieties, and generally, as it is here, accompanied by tremolite and forming large nodules in primary limestone. In Rannoch I have also found it imbedded in a primary micaceous limestone, in distinct crystals, resembling those specimens found at the Lake Baikal. In this place it is accompanied by quartz, titanite, and oxidulous iron. In Glen Tilt it forms distinct beds in the primary limestone, and in this situation also it is accompanied by tremolite. The augit which occurs in the pink marble of Tirey sometimes presents large, distinct, imbedded crystals, an inch in length, of a dark green or nearly black colour. These resist decomposition longer than the limestone, and are consequently found protruding from its surface when that has been exposed to the weather. In some places it forms shapeless masses, while in others it appears diffused through and intimately mixed with the calcareous matter; in which case, like the distinct nodules, it is often attended by an investing zone of greater hardness than the general mass of the rock. But its most common appearance is that in which it is generally known as forming a constituent part of the marble; in this state it is the coccolite of mineralogists. The crystals are occasionally defined; but most commonly they are either partially rounded or entirely shapeless, forming irregular grains sparingly dispersed or accumulated in larger or smaller groups. These accumulations are sometimes very considerable in size, and admit of being detached in large and well characterized specimens, the grains varying much in colour, being black, dark bottle-green, blueish green, and pale grey.

The sahlite presents many varieties both of form and colour, and is either compact or crystallized. In colour it is snow white and opake, or white and glassy; from which it passes into several shades of grey and green, and more rarely into pale sky-blue; presenting several intermediate gradations from opacity to absolute transparency. The crystals appear under different forms. The most perfect is a slightly rhomboidal prism, which is sometimes truncated on all the edges, the truncations increasing in breadth till an octagonal prism with nearly equal faces is produced. In other instances the truncations are limited to two edges, in which case an hexaedral prism is the result. This prism is often much flattened, and at times quite thin, the two truncated edges extending till the original faces are nearly excluded. Some crystals present a very flat tetraedral prism, but as they are much imbedded and difficult to examine it is not easy to ascertain how this variety is produced. The faces of the flat prisms are sometimes rounded, and this convexity occasionally extends to the faces of the summits also, so as to produce a very irregular body. In this state it shows the transition into coccolite, that point at which all form vanishes; the appearance of these curved surfaces resembling that which might be conceived to take place from an incipient solution of a regular crystal; as if the angles had been rounded off into the neighbouring planes. The terminations of the crystals, when perfect, are, in their most simple state, tetraedral pyramids.

Their summits are sometimes truncated, but no further regular modifications of this part of the crystal were observed.

A regular transition occurs between the sahlite thus described and coccolite, exactly similar to that which takes place in the augit; and masses of coccolite are thus found of considerable size and of different colours. The most remarkable of these is snow white and opake, forming a new and beautiful variety of this substance. From this it passes into various shades of grey, equally loose in texture, and falling into distinct grains when injured. The specific gravities of these several varieties are nearly the same; and it is remarkable that the whitest varieties which seem to contain no metallic matter, are equal in weight to the darkest, which contain so large a proportion of iron.

The sahlite, as I have already mentioned, is frequently accompanied by tremolite. The crystals of both substances are often intermingled and confounded together, or a crystal of the former penetrates and mixes with one of the latter in so intimate a manner, that as the two substances have frequently the same colour and splendour, it is not easy to distinguish them. In one of the specimens found, a crystal is divided longitudinally, the one half being of tremolite the other of sahlite. The tremolite presents a very beautiful variety; forming groups of separate crystals, which are in the usual shape of very flat rhomboidal prisms, interwoven together in a distinct manner and with large cavities interposed; the crystals being two inches in length and three quarters of an inch in breadth. In texture it is glassy, and being translucent or nearly transparent, is of a watery white. Mica is found intermixed with the sahlite, in small crystals of a talcose aspect; and it occurs in a similar state in the limestone of Glen Elg, accompanying the two minerals above mentioned.

The last mineral to be noticed is sphene, which is found in the pink marble, the crystals being minute, rare, and not easily discovered*.

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* It has been said that corundum was formerly found in Tirey, but no specimens of it have been produced. As the several varieties of pyroxene, with the exception of the coccolite imbedded in the pink marble, had then been overlooked, it is not unlikely that some of these have been mistaken for this substance. It appears also that the blue variety of sahlite has been recently mistaken for hauyne.

COLL.*

The dimensions of Coll are very similar to those of Tirey, its extreme length being about twelve miles and its mean breadth somewhat less than three. In the general outline of the coast it also resembles that island, although the extent of the rocky shores is perhaps greater in proportion to that of the sandy bays. It differs, however, materially in its general aspect and surface, being so much covered with rocky hills and protuberances as scarcely any where to exhibit a continuous level, or grassy plain. Towards the northern end of the island these indeed abound to such a degree, that when viewed from a low point of sight, it seems to present but one entire surface of rocks. Notwithstanding this aspect of barrenness it is interspersed with green spots of greater or less magnitude, which are estimated to comprise, in arable, meadow, and pasture land, about one third of its extent. Towards the southern end there is a considerable tract of unencumbered land, the rocky elevations being here more sparingly dispersed and this side of the island approaching more nearly in its general character to the neighbouring parts of Tirey. Patches of sand are interspersed among the verdant soil in this quarter, and more particularly toward the southern and western shores, where, in some places, it has so far accumulated as to overwhelm and destroy considerable tracts. These accumulations are occasionally thrown up into irregular banks and hills, as is usual in similar cases, being again dispersed by the winds as they succeed in destroying the feeble protection which the Carex arenaria, Triticum junceum, and other plants indigenous to blown sands, afford against their violence. It is not long since the utility of these plants has been known to the natives, and it is with some difficulty that they are even now restrained by the more enlightened proprietors throughout the islands from destroying them, and thus accelerating the progress of this wasting inundation. The use of the Galium verum as a dye, is the chief inducement to this pernicious practice. The sand consists in a great measure of broken shells, mixed, however, with the quartz which arises from the decomposition of the gneiss. Being thrown on the shore by the prevalence of the western swell, it is dried by the winds and dispersed by a gradual progress into the more inland parts. Thus, in particular places, and in proportion to the obstacles it encounters, it forms banks and sand hills; or else is diffused over the flatter tracts, where the renewal of vegetation tends to consolidate and retain it, thus permanently raising their level. In other situations it produces a soil on the naked rocks, accumulating in their sheltered interstices and forming a basis for a vegetation to be ultimately extended; while it operates as a constant manure to the peaty tracts within its reach, loosening the tenacious soil and promoting the vegetation of white clover and other useful plants, in place of the scanty covering of rushes and useless vegetables with which they were before encumbered. Thus, like manures, it is injurious only by excess, and in recording its devastations, it is but justice to describe its beneficial properties*.

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* Coll, a hazel; coil, a wood; Gaelic. If this be the etymology, the character of the island is much changed since the name was imposed. See the general map.

The plants which cover the sandy plains of Tirey abound here also, perfuming the air around, and in the season of flowering, prevailing so as to conceal the verdure from the eye. A small tract, known by the name of the variegated plain, presents an enamelled carpet of undescribable gayety, being covered with all the ordinary meadow plants, together with a profusion of the brilliant crimson flowers of Geranium sanguineum. Spring has here a character no less remarkable for its novelty than its splendour. Although protracted till late in June, and though no trees are seen bursting into leaf, the colours which deck the ground, the perfume that fills the air, and the melodious note of the wood-lark, produce an effect, striking both in itself and in its contrast with the desert of rocks and the wide ocean which every where meet the eye.

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* To the other advantages derived from the sand inundation it may be added, that it often produces valuable and permanent additions to the extent of the islands exposed to its influence. A great part of Tirey appears to be of no very distant origin, having been formed by its accumulation on a ledge of low rocks extending between the hills that occupy the extremities of this island. The traditions which record the recent existence of salt water inundations in its central parts confirm this opinion.

Besides the plants just mentioned, a few others, less common, are met with in profusion throughout the island. These are, Thalictrum minus, Ophrys ovata, Satyrium hircinum, Orchis conopsea, Orchis mascula, Sedum anglicum, Rosa spinosissima. Crambe maritima occurs also in abundance along the sandy shores on the western side, and the beautiful Osmunda regalis is found abundantly in the interior and moister parts of the island, while the small lakes are covered with the brilliant flowers of Nymphœa alba, and the less conspicuous Potomogeton heterophyllum. Coll, however, cannot be said, any more than Tirey or the other islands of these seas, to possess many plants remarkable for their rarity. But the Eriocaulon decangulare, hitherto found only in Sky, forms an exception to this remark, growing in some of the central lakes in company with Lobelia dortmanna, and attaining a much larger size than it exhibits in that island.

In the agriculture of Coll there is little to be remarked, if we except some superiority of management arising from the example and knowledge of the proprietor, which would not be a repetition of what has already been said on this subject in describing Tirey. Barley, to which the sandy soil is best adapted, is here the principal grain, oats being less in use; rye is sparingly cultivated, but with indifferent success. The chief cultivation is found at the southern end of the island, where there are uninterrupted tracts of even land; while among the more rocky spots towards the middle and northern divisions, the crops are seen occupying small patches and single ridges in a dispersed manner.

The middle parts of Coll contain numerous small lakes, rarely of any great depth; together with accumulations of water scarcely deserving of that name, and occasional marshy spots. The lakes are said to amount to forty in number. Like Tirey, nevertheless, it is deficient in running water, scarcely a spring or a stream being found in it, although water may often be procured near the surface by digging. This defect, which is attended with much occasional inconvenience, must be attributed partly to the small elevation of the land, partly to the nature of the rock, and still more perhaps to the climate, which, though far advanced in the western ocean, is dry; the clouds passing unchecked over this as they do over most of the flat islands of these seas.

To the lover of the picturesque, Coll, like Tirey, offers no scenes to engage attention. The hills are without elevation or variety, while no plant taller than heath grows on them. A turbulent sea breaks on a shore without features, and the distant boundary is almost every where the line of the horizon. The castle is a rude building, situated on the sea shore in a position disadvantageous for effect, without character, interest, or accompaniments to give it a value in the painter's eye; and the Danish forts, as they are called, which are found in various parts of the island, have little remaining beyond their names to mark the places which they once occupied.

There are some differences between the geological features of Coll and Tirey, although gneiss constitutes the mass of this island also from one extremity to the other. No limestone, an object always of great research for agricultural purposes, has yet been observed, although it is not improbable that among the thousands of grey rocks which cover its surface, some calcareous beds or masses may yet be latent under the covering of grass, heath, and lichens.

The gneiss is disposed in rocky hills, sometimes crowded, at others distinct, of an elevation seldom or never attaining 500 feet, interspersed with smaller protuberances, and extending over the whole surface of the island. Towards the southern and western parts it exhibits in many places a regular disposition in beds, of which the alignment can often be traced for a considerable space, straight, and free from all that disturbance which marks the rocks of Tirey. Towards the middle and the northern end of the island this order is not so visible, the masses appearing to be disposed in an irregular and dislocated manner. The direction of the beds, where it can be traced, is north-easterly, and their dip is toward the east. Their elevation is generally considerable, often reaching to seventy or even to eighty degrees, and seldom declining so low as to fifteen.

The mineral composition of the regular and irregular beds is not essentially distinct, though their external aspect differs: hornblende is found in all, as in Tirey. The laminar structure is sometimes evanescent; in which cases the rock borders so nearly on granite as to be scarcely distinguishable from it. In other places it passes at one extreme into hornblende schist or into an ordinary hornblende rock, while at the other, by the exclusion of the quartz and hornblende, it becomes merely a mass of felspar. Between these two there are seen numerous and nameless varieties, differing both in texture and composition. But it is most usual to find specimens variously proportioned with regard to their ingredients succeeding each other in parallel and alternating laminæ: and since mica is often superadded to the triple compound of felspar, quartz, and hornblende, the various ways in which this mineral is disposed tends still further to increase the number of varieties.

Although the gneiss which is irregularly disposed, resembles in composition that which displays a parallel position and rectilinear direction, it is distinguished by some important peculiarities. It is every where traversed by innumerable small reticulating veins of granite, a circumstance so well known as a frequent characteristic of gneiss, as to need no further description. It exhibits at the same time the most capricious contortions. These reticulating veins occur but rarely in that gneiss which is disposed in a regular manner; or rather they are almost altogether absent. Instead of them there are to be observed in this variety of the rock, granitic laminæ, which are parallel to the position of the beds and of course alternate with the real gneiss. They are easily distinguished by the total absence of foliated tendency: in hand specimens no question would remain respecting their place among the granites. In many cases, however far they are traced, they still appear to be uniformly parallel to the gneiss and to avoid any interference with it; while in others the parallelism is but temporary and they at length quit their even course, becoming either thicker or thinner, or cutting in upon the course of the laminæ. Hence, although we might, from the instances first quoted, conceive them to be regular beds of granite alternating with the gneiss, the occurrence of even one deviation of this nature is sufficient to prove that they are disposed in veins, of which the directions are parallel to its laminæ. It is easy to understand why the parallelism of the gneiss is preserved where it is traversed by veins of this nature, while its evenness is interrupted and contortions produced in the beds, where their course is irregular or transverse. The smaller granite veins, whether parallel or transverse, have most generally a fine grained structure with the aspect of an ordinary granite, although this rule is far from absolute. But both the regular and the irregular gneiss are traversed by larger veins which produce an occasional disturbance in each. In the irregular they only add a little to the general confusion, and even in the regular beds they seldom produce so much displacement as materially to divert them from their general tendency, unless where they are very numerous. These veins have almost always a peculiar aspect, containing a large proportion of felspar with but little quartz, the mica being also either sparingly dispersed or altogether absent. The concretions of felspar are often of great size, the substance itself having a high glassy lustre: the veins also frequently assume the graphic character. Towards the southern end of Coll veins of similar dimensions occur among the gneiss, disposed in the same manner, but formed of a peculiar rock, which I slightly mentioned in describing Tirey. The basis of this substance is a quartz possessing considerable transparency and an oily lustre, and containing crystals of red felspar thinly disseminated. Similar compound occurs in the gneiss of Sky.

There remain still to be described two circumstances which are important towards the general history of gneiss. Distinct beds of mica slate are found regularly alternating with it in several places. A still more remarkable appearance is that of a bed similarly situated and consisting of a conglomerated rock formed of fragments of quartz imbedded in a micaceous schist; offering an example of a breccia in a situation where these have not been supposed to exist. This rock is to be seen in a small bay near Ben Feoul.

It is unnecessary, after the remarks on that subject in describing Tirey, to renew the question respecting the contemporaneous nature of the granite veins of gneiss. But it is quite obvious throughout Coll, wherever the beds possess sufficient regularity to render that circumstance perceptible, that they are shifted by the passage of those veins. I have given two examples of this nature in a diagram*.

An equally remarkable instance of apparently mechanical arrangement occurs at the southern end of the island, of which there is also a representation subjoined†. Analogous appearances must be familiar to all those who have had opportunities of examining rocks of this nature; but the present example is interesting chiefly on account of its magnitude and of the apparent instance of softening and flexion which it affords. The nodules of hornblende rock here represented are of considerable size, attaining a diameter of three or four inches, and the laminæ of gneiss are every where bent over them, as if they had, when in a soft state, been forced by external pressure to accommodate themselves to the previously indurated concretions.

Such are the principal geological features of the gneiss of Coll. I shall not here attempt to draw any further general conclusions from the appearances which have been described, since a considerable tract of the same rock remains to be examined. If any useful views are to be deduced from the comparison of facts, they will be more easily and more certainly established when a greater body of materials shall have been accumulated.

Since mica is an ingredient of gneiss, it cannot strictly be considered an adventitious mineral; yet it is here found in concretions so large as to require notice among the mineral substances to be enumerated. It is always black, at times crystallized, and in other cases disposed in large plates without definite forms. It is very often mixed

* Pl. xi. fig. 1, 2.

† Pl. xxvi. fig. 1.

with hornblende in such a manner that it is difficult to distinguish one ingredient from the other. This is particularly the case where the specimens are broken by a cross fracture, the micaceous ingredient being scarcely visible unless when the rock is split in the direction of its laminæ.

It is hardly necessary to say that hornblende in a distinct state is also found in this gneiss, since it must already have appeared from the description of that rock, in which beds of hornblende schist and hornblende rock are mentioned as occurring. This hornblende is black and of the most usual aspect, and is occasionally found in the form of aggregated crystals of large size, offering a beautiful variety for the collectors of mineral specimens.

This mineral occurs also in Coll under a different aspect, but much more rarely, since I only observed it in the neighbourhood of Ben Feoul. It is of a platy fracture and bottle-green colour, with a lustre approaching to the metallic, being little less splendent than hypersthene or diallage, with the latter of which it may easily be confounded. I may add that similar specimens of hornblende are occasionally found in mineral collections arranged under this title. This substance is found entering into the composition of a rock of which the other constituents are common black hornblende and black mica; being sometimes mixed throughout the mass, and at others forming large and distinct concretions. At times also, quartz as well as felspar enter into its composition, and the compound presents in this way various specimens of considerable beauty. The rock itself constitutes a bed alternating with the ordinary gneiss. I may further add to this enumeration of the varieties of hornblende, that a lamellar and green kind much intermixed with pyrites is found forming a rock in the same neighbourhood. This variety does not possess the metallic lustre which characterizes the former.

Actinolite is also found in Coll. It is of a bright green colour and of a lamellar structure, forming in some cases a constituent part of the gneiss, while at the same time it may be observed in the state of distinct concretions dispersed throughout the beds. In such instances it sometimes occupies cavities, and is then regularly crystallized. It occurs in the same manner in a kind of quartz rock which appears to alternate with the gneiss, but which was not described in speaking of the other alternating substances, because from its inaccessible position I could not pronounce decisively respecting it. Both these rocks are remarkable as well for their peculiarity as for their beauty, when considered as mineral specimens.

A bed occurs among the gneiss at the foot of Ben Feoul, of a singular aspect, but appearing to be principally composed of actinolite under some modification. It is of a confused lamellar structure, the lamellæ having a tendency to the fibrous fracture, and being of a dull purplish brown colour. On a nearer examination it is found to contain interspersed crystals of the green lamellar actinolite which occurs in the gneiss above described. The brown part which constitutes the main body of the rock, is opake and dull, but possesses in every other respect the characters of the green part; and a perfect idea of it may perhaps be formed by imagining it to be the same substance overcharged with an oxide of iron, just as quartz sometimes is with chlorite or calcareous spar with sand.

Garnets are found in the gneiss, here as in many other places, but they are neither abundant nor well defined, being at the same time confined to those laminæ which possess the most granitic aspect and structure. Massive brown garnet is also found in large irregular lumps, diffused, as it were, through the rock.

Independently of the more common forms in which quartz here appears, it occurs also under some of its less frequent modifications; these, as far as I have observed in Scotland, seeming to be always limited to gneiss. The most remarkable example is to be seen on the face of a rock not far from the house of Coll, where it appears to form part of a vein of which the side has been exposed by the falling down of a bed of the gneiss by which it was bounded. Its aspect is often waxy, an appearance very common in the quartz veins that traverse gneiss, while at times it assumes a character resembling that of chalcedony. The structure is generally lamellar, and it is traversed by fibres or strings of a whiter colour and of greater opacity. On exposure to air it becomes dry and harsh, losing much of its transparency. Where it possesses the greatest degree of transparency it is opalescent, being the milk quartz of mineralogists, and either exhibiting a whitish and diluted milky hue, or a tinge of blue, purple, or pink. These latter specimens resemble the well known rose quartz, but are rarely of sufficient magnitude, purity, or intensity of colour, to possess much value in the esteem of a collector.

Felspar also occurs in great variety and beauty, appearing, like quartz, to be subject to more numerous modifications as a constituent of gneiss, than when it enters into the composition of granite. It is found in large concretions, sometimes occupying the granitic laminæ of the gneiss, and at others the veins of graphic granite. Its colours are various, being white, red, brown, and grey, the specimens having often a pearly aspect and sometimes a glassy and splendent fracture. The graphic granite which contains these glassy varieties is often exceedingly beautiful, and as lichens rarely find a lodgment on its surface, it dazzles the eyes when in the sunshine by the play of reflected lights. It is worthy of remark to mineralogists, that in these cases the incident rays are reflected to the spectator's eye from a great extent of surface, although that is often very irregular. The reason is obvious, this effect resulting from the disposition of all the reflecting faces being parallel, however distant and minute they may be, and however separated from each other by the intervening quartz which forms the remaining part of the mass. We may either consider this parallel disposition as the result of a common polarity or crystalline tendency in all the minute portions of felspar which are aggregated to form the vein, or may suppose that the whole mass of rock is a portion of one crystal of felspar, interrupted by intervening crystallizations of quartz. Similar arrangements arising from a common polarity among distinct crystals are not uncommon, and must have occurred to all mineralogists. Cases perfectly resembling this are of frequent occurrence in augit rock, and are noticed in different parts of this work. They occur also in the sandstone of Arran, described in another place. Among minerals I have observed it most frequently where mesotype and needlestone are associated with stilbite and analcime, the former substances maintaining their rectilinear course without regard to the interruptions caused by the latter. In one remarkable instance in my possession, where detached tabular crystals of oxidulous iron occupy the surface of a mass of rock, they are disposed in those curves which indicate the directions of the magnetic current between the two poles of the needle: an interesting point of resemblance between the effects of magnetic and crystalline polarity.

A vein of lead ore has long been known in Coll. It is a narrow string of steel-grained galena lying in a fissure of the gneiss and terminating in the sea. This fissure forms an angle of about 20° with the course of the beds. The ore is not accompanied, as far as it is visible, by any other substance, and, offering no prospect of profit, it has not been wrought.

I have deferred to the last place the mention of augit, because, not having found it *in situ*, I am in doubt whether it may not be a transported rock. The specimen in question was a single block, and being at a great distance from the shore there is no reason to think that it had been brought in ballast. Otherwise it might be imagined to have belonged to the Island of Rum, of which that substance forms a large portion. Yet there are no rocks of the trap family in this island, if we except veins, to justify the notion that it is in its native place.

These veins are by no means common, but they may be seen in different places. Their dimensions, as far as I observed them, do not exceed four or five feet, and they are formed of a black compact basalt. They are often characterized by a tendency to the columnar fracture, and do not seem materially to disturb or influence the rocks which they traverse.

BARRA.[*]

This island[†] is of a very irregular and indented shape, containing but a small surface compared with its extreme dimensions, which are ten miles in length, by seven in breadth. If indeed the hill above Kilbar be considered only as an appendage, its length will be reduced to seven miles. This appendage of Barra consists of a single hill, connected with the remainder of the island by a flat sand, over which the western and eastern seas almost meet at high water. They have probably been at one time separate islands, subsequently united by the sandy isthmus which the action of the waters has thrown up; nor is it impossible that in some of the revolutions to which these shores seem exposed they may again be separated. Toward the southern and western side of the island arises one high hill scarcely attaining the height of 2000 feet, descending to Chisamil Bay and declining to the north and east in a succession of lower hills which terminate in various rocky points on the shores. The intervals of these rocky promontories are occupied by sandy bays communicating with small valleys in which the population is accumulated. These valleys present a soil composed of a mixture of peat and sand, and near the shores, of sand only; while the hills offer nothing to the eye but a motley mixture of peat and rocks, affording but scanty pasture to the black cattle which form the chief agricultural wealth of the island.

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[*] Bar-ey—The island of Saint Bar; probably its apostle.—I must here remark once for all that the orthography of these names is variable, such variations having probably arisen from the marked difference between the Gaelic orthography and pronunciation. In this particular instance however, the terminal syllable is not Gaelic, but Scandinavian. Ey, for eyland, island; hence the termination by which many of these islands are distinguished, its orthography having nevertheless in process of time been generally corrupted into the terminal a. Thus, Canna, Rona, Vatersa, Sandera: in some few the terminal is spelt ay, and in Tirey it continues unchanged.

[†] It is proper here to say that the whole of the westernmost chain from the Butt of the Lewis to Barra Head is known to the natives by the name of the Long island; a term which I have often found it convenient to use. See the general Map.

THE rocky shores abound with fish, principally ling; in the pursuit of which the inhabitants are very industrious. When cured they are carried by the fishermen themselves to Greenock, and in this way much time is unprofitably occupied; an evil, which a greater extension of the fishery and a proper commercial arrangement would easily remedy. But society here is not yet advanced to the state that admits of those arrangements; and to this want is in part owing the very inadequate manner in which fishing is conducted along many parts of this productive shore. The impediments arising from the want of commercial arrangements, and the deficiency of capital, are not, however, universal in the maritime Highlands; as establishments under the direction of capitalists, exist in various parts of the western coast, and are followed by the results that might naturally be anticipated.

To the preceding causes must be added the difficulty of reconciling the often incompatible pursuits of farming and fishing; the most active season of the fishery being frequently that where the attention of the fisherman is also required at home, to conduct the operations of agriculture, on which he must still depend for the chief part of his subsistence. It is obvious that the state of the country is not such as to admit of a ready or constant market for immediate consumption, which is therefore limited to the families of the fishermen themselves. Under these circumstances, there can be no effectual or extensive fishery, nor any endeavours to take more than is required for domestic use; unless where the small fishermen are enabled to salt and retain their several stocks, till they accumulate so as to render them sufficient for a distant market. To the natural impediments arising from want of capital, by which this is checked, must be added the difficulties inevitably arising from the nature of the salt laws. To favour the fisherman and promote the commerce in the salted commodity, and at the same time to check the frauds that might follow the misapplication of the salt allowed for that purpose, have been found matters of considerable difficulty. Complaints, as may naturally be expected, abound on this subject, and, to remedy the real inconveniences, many regulations have at different times been adopted, with more or less success. It would here be out of place to attempt a description of these several regulations; as the subject is not only trite, but the changes have been so numerous, that to notice them would lead to a considerable length of discussion. To render the Highland fisheries effective, has been an object of much anxiety, and if the expedients have sometimes failed, they have at least been intended to reconcile the more local interests of the country with the general advantages of the empire.

Similar attempts have been made to temper those regulations which, in the case of these remote islands would, if rigidly enforced, produce inconveniences without any adequate advantages to the revenue. The restrictions on the private manufacture of candles are of this nature. Such restrictions can be attended with no inconvenience in a commercial country, but they would here be oppressive as well as useless; as there is no market for the sale of the raw, or the purchase of the wrought material, and the former would of course become unconvertible. A discretionary power is therefore judiciously intrusted to the officers in this department of the revenue, by which this manufacture is permitted for domestic use, under certain regulations capable of checking abuse without producing inconvenience.

As grievances, real or imaginary, must exist every where, it will not be a subject of wonder if many other complaints are found among these remote islanders; although a patient submission to inconveniences and privations, forms no small feature in their character. It is pleasing however to observe, that they are never directed towards the government; an attachment to which is one of the most striking traits of the Highlander's character; to him who has been accustomed to the political ill-humour of the lower orders in England. These grievances are generally however the consequence of circumstances so essentially interwoven in the system of the country, as to be irremediable; often proceeding more or less directly from a crowded population, from poverty, and from the remoteness of the situation. In a few instances, they appear rather to be traditional than real; the gradual influence of a number of concurring circumstances, having long since removed most causes of complaint. If we consider the general poverty of the people, the distance of the seats of justice, the great competition for land, and the dependance on the landlord thence generated, together with the accumulated influence which the situation of proprietor and magistrate combined, gives to the great landholders or their agents, it is gratifying to reflect that so little just cause of complaint exists. The instances of oppression which are occasionally related to strangers, will be found to belong to a period now for some time past; nor indeed are the people willing to submit to an improper use of power, even if their superiors were inclined to exert it. If the southern traveller imagines that he sees the spirit of feudal government still hovering over the dead body, he will also see that it has long lost its hold over the minds of the people.

A suggestion has recently been made, which would remove one inconvenience frequently represented to strangers in their visits to this country. It relates to the collection of taxes. The produce of these being so small, no collector is appointed to receive them on the spot, and they must therefore be paid at the county town, which in the case of the island now under review, is Inverness. The inconvenience that may hence arise, in the case of errors, is obvious. It has been proposed to place the collection in the hands of the officers of excise, whose leisure, and residence on the spot, would enable them to perform this additional duty with ease to themselves and the people, and at a very slight expense.

Inconveniences also arise from the difficulty of communication which results from the deficiency and imperfection of roads, ferries, and post offices. With respect to the former, much has been recently done to remove them, but more is yet wanting. It would be too much to expect universal satisfaction where so many jarring interests are concerned, and where misrepresentation must sometimes inevitably defeat the best intentions of the government. There can be no doubt that its interest is concerned, in promoting for the general welfare, those improvements which the individuals are, in districts so poor, unable to undertake. If its intentions are occasionally obstructed by the particular views or imaginary interests of proprietors, it is no great matter of surprise. The tedious and limited communication by posts is often injurious, by preventing an early knowledge of the fluctuations of prices in the articles of export. Thus speculators in kelp, cattle, or wool, frequently profit by the ignorance of the producer. Where agriculture has a character so commercial, the freedom of communication cannot be too great. If a small sacrifice of immediate revenue is made for this object, either by the proprietors or the government, it will be ultimately replaced by the improvement of the country at large.

A few remarks of a different nature remain to be made on the fisheries. They have been productive of advantages to the proprietors, and consequently to the country, in a way which does not appear to have been originally foreseen, however well it is now understood. These advantages consist in the increase of value which the lands have undergone by their extension, even where that extension is still limited to a partial domestic supply. Hence arise the chief benefits of the crofting system, the most efficient and profitable changes of this nature having been the allotments of small farms on the sea shore. Rents have thus been obtained for farms of a division so minute as to have been nearly incapable of paying any from their surplus produce. In a similar manner a revenue has been derived from tenements which produce no surplus, the rent being here analogous to that which arises in the vicinities of commerce and of manufactures; a price paid for the accommodation requisite in the fisheries, and a portion of the wages of labour. A superficial view of the limited produce and of the apparently high rent of many Highland farms of this nature, has thus been often made a ground of ill-founded censure on the proprietors; who perhaps have not been sufficiently careful in rendering the nature of this operation intelligible to their tenantry; if indeed it be possible to render intelligible to them what their better informed neighbours are so often incapable of understanding. It is no small matter in this case, as in that of taxation, to prevent a confusion of the semblance and of the reality. The grievance of a tax exists too often when the real tax is levied on an individual very different from the imaginary sufferer. An instance of an injudicious attempt at this distinction occurs in one of the islands under review. Here, the proprietor levies a rent on each boat employed by his tenantry in fishing. The consequences are obvious; grievous complaints are made of oppression and of injustice. Yet this is a case not of rigid justice merely, but of mistaken lenity, since he whose indolence or incapacity prevents him from fishing is exempted from that rent which the land alone would not allow him to pay without inconvenience or ruin. The regulation is however in every respect inconsiderate, since it not only creates an imaginary evil, but operates as a discouragement to the fisheries, on which the proprietor must in a great measure depend for his rent as the tenant also must for his subsistence.

A stranger who for the first time sees the miserable cultivation which is carried on by the smallest class of tenantry among rocks and bogs, will be surprised to find that any rent can be paid from the produce of such possessions; in other situations they would pay none, or rather they would not be cultivated, since they could not repay the expense of cultivation so as to leave any profit to the occupier. Here, the great and increasing competition for land necessarily generates a rent which the habits of the farmer and the small quantity of food and accommodation he requires enable him to pay. Such rents are in many instances called oppressive. In this view it may truly be said that any rent is oppressive; but even the abandonment of a rent, which in the case of the small tenants rarely exceeds £3 per annum, would not remove the evils under which this country labours. The fault lies deeper, and is compounded of the excess in the quantity, and the defects in the distribution of the Highland population.

It is this also which constitutes the chief obstacle to the proper improvement of the land. It cannot be said that there is a want of industry or a deficiency in the labour bestowed on this object, when we examine the spade cultivation by which the small farms are generally conducted, and which was already noticed in treating of Tirey. There is, in fact, a super-abundance of labour applied to it, which under the proper direction of capital would effect useful and permanent improvements; it is lost because it is wasted in the pursuit of those which can only be temporary. There is no want of industry, but it is mis-directed. Here again the proprietors suffer under the unjust censure of impeding improvements by withholding leases. But a lease to him who has no capital is nearly useless, while the only security which the landlord can retain for the productiveness of the soil, is the power of withdrawing the farm from him who neglects it, and bestowing it on some other of the craving competitors who are surrounding him, and who come with the double claim of equal wants and greater industry. When the system shall change by the enlargement of farms and the introduction of a superior class of tenants, the proprietor will naturally dispose of his land with the same regard for his own interest as his Lowland neighbours; that interest and those of his tenants, as well as of the community at large, being seldom at variance. Before quitting this subject, it is however not uninstructive to remark, that although there can be no question respecting the improvements of waste lands daily making by the new classes of small tenants under separate holdings and securer leases, yet the ultimate value of these improvements appears to have been over-rated by speculative persons. They are generally on too small a scale to be of future advantage when the advance in the state of farming shall cause larger tracts to be occupied. That rough land which from its nature has been necessarily cultivated by the spade, must be thrown into pasturage when more perfect and economical cultivation by the plough shall have been introduced. Under any circumstances but the present crowded population, and low value of labour*, the cultivation of such land must cease altogether; and it will cease when labour shall become disposable under capitals less divided; and when these, directed to more legitimate objects, shall seek for employment in the breaking up of new lands. These small holdings will therefore be eventually abstracted from the permanent mass of improvement, and those writers who consider the present changes as both the commencement and indication of legitimate and effectual improvements have consequently misled themselves. A small addition of improved pasture may remain, but the system is temporary, and so far from being the first stage of general improvement, is merely an amelioration of the old imperfect and imperfectible one. It is evident, on reviewing the effects of this system, that if the same quantity of labour and expense which have been bestowed on small improvements in these islands had been directed to great ones, they would here, as in Isla, have brought extensive tracts into a regular and permanent system of cultivation. But the present practice is inseparable from the present state of the population and the holdings of farms. Capital is wasted since it produces neither permanent change, nor accession of capital, nor augmentation of the means of future progress, but must always be renewed; and it may fairly be said that the wretched Highland crops are raised at an expense much greater than their value. The introduction of capitalists and the enlargement of farms are the true foundation of the improvement to which this country must look.

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* It must be remarked, that the low price, or rather value, of labour mentioned here and on other occasions as the result of excessive population, is virtual only; it is not marketable labour that is meant. On the contrary the price of hired labour in these districts is excessive, or rather, the article is not to be procured. Hence the peculiar state of the kelp manufactory, besides numerous other evils which impede the progress of agricultural improvement. The causes must already have been too obvious to require detail.

A SMALL fresh water lake is to be seen at the southern end of this island, containing the ruins of a tower; the residence of some ancient chief, or a place of refuge for his family. There are no other lakes of any note, and not a single permanent stream of water exists in the country. A few dry channels of water courses are visible on the sides of the hills, which an occasional shower fills, but which are speedily drained on its cessation. Springs are almost equally deficient, a character which will be found very general throughout the remainder of the islands connected with Barra, other general features, as will hereafter be seen, pervading the whole.*

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* One of the exceptions to this rule is somewhat remarkable. On a small rock about half a mile from the shore in Chisamil bay, stands a Castle, once a strong hold of the Macneils of Barra. It is tolerably entire, and consists of an irregular square area, enclosed by a high wall and containing numerous buildings capable of accommodating a considerable army, as the armies of the sovereigns of those days were; perhaps 500 men. A high and strong square Keep, with no entrance but by a flight of stairs, occupies one

The deficiency of water arising from the want of springs is, in an economical view, a source of much inconvenience, not only to the inhabitants, but to the shipping which frequent the harbours. None can be obtained in summer except in the small cavities which the roughness of the ground leaves in the winter water-courses, and this, being the drainage water of the surface, is impregnated not only with peat, but often with less innocent matters. In a geological view some peculiarities seem to originate from the same cause. No banks or deposits of alluvial matter are to be observed in the flat parts of the island or on the sea shores; nor are there any beds of clayey soil in situations where they might be expected. There is indeed very little soil in the island, if we except the hill above Kilbar. In general the peat lies almost immediately on the bare rock in the higher parts; while on the western side many feet in depth of sand are accumulated by the incessant blowing up of that which the sea rejects. The intermediate land offers the best soil for agricultural purposes, being composed of such a mixture of peat, earth, and sand, as might be expected from its situation; the one or the other being predominant in proportion to the vicinity of the sea or of the mountain; or the greater or less facility with which the sand drift is enabled to sweep it. The small quantity of clay which enters into these soils is some-

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corner of the area. The opposite angle contains a narrow tower, which appears to have been the prison. The walls are embattled on one side, and provided with a covered way and loop-holes. A small circular flanking defence covers the dungeon tower; the remainder of the walls, as is most common, are suffered to rely for protection on the goodness of their masonry. Near the entrance, which is at one of the angles of the Keep, are the foundations of a circular enclosure or basin, which was probably intended as a place of security for the boats of the castle. In the centre of the area is found the spring of fresh water alluded to, which, arising in the middle of the sea, is an object of much wonder to the natives. It is secured with masonry, and arched.

times found forming very thin beds under the peat, which is however in general much too deep to admit of this matter being reached by the agricultural processes in use, so as to be brought into action.

As there are no beds of the usual alluvia of flat lands in Barra, so there is none of the mountain alluvial matter so common in hilly countries, which consists of mixtures of angular stones with clay. The gneiss of these islands appears indeed to be of a very refractory nature, undergoing little change from the action of the atmosphere. The surfaces are smoothed as if from the very slow effects of air and water, but in general the angles are tolerably sharp, and the traces of fissures penetrate to no depth. Every thing appears in its place; the precipices which result from the fall of rocks are rare, few fragments are scattered about, and those which are, have an integrity and freshness rarely found in any other class of rocks in Scotland. A spectator cannot help being struck by the aspect of obstinate durability which they display. If we compare this gneiss with granite, with mica slate, with quartz rock, with limestone, or with trap, its superior powers in resisting destruction will be strikingly apparent; while the imagination is lost in reflecting on the slowness of those changes by which many parts of the rocky globe were first made fit for the habitation of plants and animals.

The difficulty with which this rock decomposes into earth, is the evident cause of the nakedness of the surface. If the lichens find a hold, it is true that they are followed by their usual attendants, the mosses, the rushes, and the grasses, which in the end produce a body of green covering wherever they can effect a lodgment. But this covering is only peat. The peat is laid on the naked rock, and the vegetation of one generation of Scirpi or Sphagnum is followed by that of others in endless succession, without change or amelioration. The cause of the extreme resistance of this gneiss is not apparent. In composition it exactly resembles granite, and in the disposition of its parts it differs but little; yet where most granites are covered with a dense coat of gravel, of clay, and of mixed vegetable soil, this rock is bare even to the very level of the sea. The absence of precipitous faces and of the marks of violent fracture will be found to arise from the same cause to which the want of springs is owing, namely, its freedom from fissures. There is no place in which water can lodge, nor consequently where the power of frost can be brought into action; that agent from which the violent fractures of rocks seem almost entirely to originate. Hence arises that peculiar character of the hills which predominates in a greater or less degree throughout the whole range of the Long Island. No serrated outline, no spiry summits, no angles nor abrupt faces vary their appearance; one rounded and tame line separates them from the sky. A few parts only of Harris and of Lewis offer an exception to this general rule. Nothing indeed can well be conceived less interesting in a picturesque view, than the whole of this chain of islands. Much amusing display of a sort of ichnographic scenery, arising from the labyrinthine disposition of the land and water, may be seen by ascending the hills, but there is scarcely any where a subject for the pencil. While the mountain outlines are tame, their groups are without complication. No trees occupy the valleys, no water-falls sparkle along the declivities, the cliffs have neither magnitude of parts nor breadth of disposition, the shores of the numerous bays are uniformly low, and the sea rocks have neither elevation nor form to compensate for the dulness of the interior country.

THE rocks of Barra offer nearly as little instruction to the geologist, as they display attractions to the lover of landscape. Gneiss is the universal substance, and with but little exception it will be found to predominate throughout the whole of the Long Island.

This rock is here so irregular that the beds can rarely be traced for more than a few yards together in a straight line. They are commonly bent and occasionally much contorted, while their inclinations to the horizon are so irregular and inconstant, that no consistency or order can be perceived among them. Still, their leading position approaches the horizontal one; unlike those of the southern parts of Coll, which not only are elevated at high angles, but show a considerable rectilinear tendency. In composition and structure they vary almost every where, the principal differences being produced by the presence or absence of hornblende, or of mica. The micaceous varieties are however rare, and the compounds of felspar and mica only, are seldom found to occupy any great space. They rather form the occasional laminæ of a fundamental mass containing hornblende in various proportions; that substance causing the laminar appearance and fissile tendency of the rock. Occasionally this gneiss passes into common hornblende schist, while in certain situations the laminar tendency so far disappears that it assumes the characters of a common granite.

Granite veins abound as usual in this gneiss, and they have in Barra a character similar to that which they possess in Coll; the red colour however is predominant.

In weathering, these rocks acquire an uniform rough surface with a slight convexity, which, together with the fissures that cross each other at considerable angles, and the occasional exposure of the veins, give to the whole an appearance resembling granite very apt to mislead an inexperienced eye, particularly from a distant point of view.

Trap veins are found traversing the gneiss, attended with some unusual appearances. In many places there are large rents filled by loose matter and vegetable soil, but appearing to have once contained such veins, of which the exposed portions have been washed out. But those which render the gneiss of Barra remarkable are of very small size, and distributed in a manner of which no corresponding examples have occurred to me in any part of Scotland but the Long Island. They are subdivided into branches of extraordinary tenuity, traversing and reticulating the gneiss or the granite veins in the most intricate manner, as either of these happens to lie in their way. However small these veins, even though reduced to the diameter of a thread, they maintain their distinctness from the including rock, never diffusing themselves throughout its substance, or entering into any compound with it, but always remaining defined by a determined boundary. They are readily distinguishable on a fresh fracture; and when the rock is exposed to the weather, it is equally easy to recognise them by their rusting and falling out, while the gneiss retains its refractory nature and aspect. In some places they are so abundant as to equal or exceed in quantity the rock which they traverse. Of this there is a remarkable example at Cuire. The original rock is a dark gneiss containing much hornblende and intersected by veins of grey granite. The trap veins are so numerous as to have separated the rock into small irregular fragments, so that the whole has at first view the aspect of a conglomerate consisting of fragments of gneiss and granite imbedded in a basaltic paste. Where it has been exposed to the weather, these have been so unequally acted on that it puts on the appearance of a tufaceous lava. I must add, that the matter of all these veins, whether great or small, is invariably identical, and is a very compact fine-grained black basalt. No large vein of basalt is to be observed in the neighbourhood of Cuire.

VATERSA, SANDERA, PABBA, MULDONICH,[*] MINGALA, BERNERA.[†]

These islands, together with a few islets of little note, form an irregular group to the south of Barra; the latter, which is the southmost point of the Long Isle, being popularly known by the name of Barra Head. As the composition of the whole is similar, and as they present but little interest, a very brief notice of them will suffice.

Vatersa is a small island consisting of two distinct hills connected by a flat sandy bar where the opposing seas nearly meet. This small tract exhibits the broken remains of sand hills standing to mark the changes which the land has undergone by the gradual and alternate accumulation and dispersion of these banks. There is nothing here opposed to the junction of the two seas, and the consequent division of Vatersa into two islands, but this bar, which the westerly swell perpetually throws up and which is again dispersed by the winds over the surface of the land. The separation of Vatersa from Barra is effected by Chisamil Bay, and by a narrow strait to the westward which affords passage only to small boats and is occupied like all the shores of this country by two or three small islands, of which Eorsa and Snoasimil are the most conspicuous.

These islands are all composed of gneiss, differing in no way from that of Barra already described. Vatersa offers perhaps more conspicuous examples of contortion and instances equally beautiful of the reticulations of the trap veins; while, as in the little island of Fudia, oxidulous iron is occasionally to be seen in the granite veins.

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[*] The hill of Duncan. Little or nothing is known of the legendary history of the Highlands, but St. Duncan must have been a personage of importance, as Sunday is frequently called Di Donich, Duncan's day. Vatersa, Sandera. Water island, Sandy island. (Scand.) Mingheal, fair. Pab, stubble. Bernera, the serrated island. (Gaelic.)

[†] See the general Map.

Sandera is nearly connected with Vatersa, with which it also corresponds in materials and disposition; forming a single hill of gneiss and attaining, like that, an elevation of 800 feet or thereabout. Although the islands of Fladda and Linga protect it in some measure both from the action of the western swell and that of the prevalent winds, it is covered by sand to a much greater height than either Barra or Vatersa; in consequence of some peculiarity of its shape which directs the current of wind high over its eastern end. This sand which, partly by its calcareous nature, and partly by its mechanical power in overcoming the tenacity of peat, has produced such excellent effects in Barra and many of the neighbouring islands, is here in such excess as to overwhelm and exclude vegetation altogether. At a distance the island appears as if covered with a coating of snow. Although small it is inhabited.

I may add that Pabba like Sandera, consists of a single hill of similar elevation and materials; having a somewhat precipitous face towards the west, and being inhabited by a few fishermen at its flatter eastern end.

Muldonich is also a single hill of 6 or 700 feet in elevation, and like the neighbouring rocks it is composed of gneiss.

As I had no opportunity of landing either on Mingala or Bernera, I can only conclude from the general characters and disposition of the rocks, and from their continuity with Pabba and Vatersa, that they also consist of gneiss. Judging from their appearance as seen from the sea and the neighbouring islands, their elevation does not appear to reach 1000 feet. Each exhibits a precipitous and rugged face, Mingala to the west and Bernera to the south.

Some future geologist will perhaps fill up the blank which I have unwillingly left, if indeed there be any thing in those two islands but what I have conjectured to exist. He will be fortunate if he is not compelled to leave much unseen, and to supply somewhat from conjectures. Though like the philosopher in Rasselas he were to find the winds and waves obedient to his word, he would still have much to encounter. He cannot ride in a land without roads, since his horse can neither tread the bogs, nor scale the rocks. Though he may walk with the strength of Antæus, and like the Arab live on the "chameleon's diet" it will avail him little, unless with the wild duck, the proper tenant of this amphibious region, he can also traverse the lakes and swim the friths. The dependance which he may place on the maritime habits of the islands will be overthrown at every step by the mis-arrangements common in this country which display so strikingly some of the characteristics of the Highlander; an almost unsurmountable indolence, and a content which is either satisfied with an expedient or submits to inconveniences of its own creating as if they were part of the necessary career of his life. Poverty is not always the cause of these inconveniences. If the poor fisherman has no rudder to his boat, no yard to his mast, or no sheet to his sail, his richer neighbour is often equally in want of them. He who has traversed these islands will easily recognise the truth of the subjoined picture*.

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* It was settled in the evening that we should visit Barra Head on the following morning. Unfortunately the laird's only boat had been left on the beach without an anchor a few days before, whence it was carried away by the tide and dashed to pieces. But there was an expedient at hand, as there was another boat in the island, and it was borrowed for the occasion. In the morning, when ready to embark, it was discovered that the borrowed oars had been negli-

ERISKA, FUDIA, HELLESA, GIA.*

NUMEROUS islands lie in the strait between Barra and South Uist, and on the eastern shore of the former, one small chain of which separates the harbour Ba hiravah from Ottervore road. The composition of the whole is precisely the same.

Eriska is the boundary of Ottervore toward the north, and is separated from South Uist by a narrow and rocky sound, being of considerable extent when compared with the neighbouring islands. On a detached and high rock at its southern end are to be seen the remains of a square tower, the ancient residence of some turbulent chieftain. This island offers also a circumstance of historical interest, having been the first place on which Prince Charles landed while on his voyage from France to Arasaik, where his disembarkation took place.

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gently left on the beach on the preceding evening, and had like the former boat been carried away by the tide. There was now a boat, but there were no oars. Oars could be borrowed, somewhere: they would be ready at some time in the day; at twelve or one o'clock; it would not be many hours too late; we could only be benighted in returning. By the time the oars had been sent for, it was discovered that the boatmen and servants were all absent cutting peat in a neighbouring island. But it was possible to find another expedient for this, by procuring some of the islanders. A messenger was accordingly sent for four men. In the meantime the borrowed oars of one fisherman were fitted to the borrowed boat of another, but alas! all the islanders were absent making kelp. Thus the day was spent in arranging expedients and in removing obstacles. Thus is life spent in the Highlands, and thus will it be spent by him who trusts to Highland arrangements for the accomplishment of his objects.

* See the general Map.

Although the gneiss of Eriska presents no features deserving of particular notice, that of Fudia is somewhat distinguished by the magnitude and number of the granite veins which it displays. Lumps of granite, apparently independent of veins, are also seen imbedded in it. From these as well as from the larger veins there proceed branches anastomosing and diverging in a very capricious manner, which the great continuity and extent of the naked surface gives ample opportunities of examining. The felspar of these veins is remarkable for its purple hue, and it is found in large concretions, as is usual in the granite veins which traverse gneiss. Large masses of confusedly crystallized hornblende are also found dispersed throughout the gneiss.

A few veins of quartz are seen traversing the rock. These are of small dimension, not exceeding two or three inches in breadth, yet they present circumstances of some importance in the history of gneiss. It has been generally supposed that the quartz veins of this rock as well as those of mica slate, were of contemporaneous origin with the substances in which they lie, or, at least, that they have been formed by a secretion of quartz into cavities produced by the shrinking of the adjacent parts during the process of induration. But these veins are here attended by a distinct shifting of the rock which they traverse; a circumstance sufficient to prove their posteriority, and the forcible dislocation of the parts which bound them, at a period more recent than that at which the rocks acquired their form and disposition. In the instance under review the changes in the gneiss belong to two distinct periods, since it is first displaced by the intrusion of the granite vein, while the gneiss and the vein together are subsequently shifted by the quartz. The subjoined drawing* will serve to give an idea of the appearances in question, as well as of a still more recent change induced by the intrusion of a trap vein.

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* Pl. II. fig. 3.

The last circumstance in Fudia worthy of notice, is the existence of oxidulous iron in the granite veins. This is accompanied by black mica, and forms detached masses of the size of an apple, or thereabout, protruding from the surface of the rock.

Although Hellesa and Gia correspond in every respect with Barra in structure and character, they exhibit one of the most striking features of that island in a still more accessible form. This is the passage of the trap veins through the gneiss. It is difficult, perhaps impossible, in Barra to trace the reticulations of the basalt to a principal mass: a geologist therefore, limiting himself to that island, might easily pass over the whole without remarking this phenomenon, or he might neglect it as one of the ordinary forms of contorted gneiss, or, if he observed it, remain unable to explain it for want of a clue. It is one of those recondite appearances in the disposition of rocks which points out the necessity of rigid and minute research combined with the more general view of broad and leading characters. On the shores of these small islands the larger trap veins are seen in various places, and they are easy of access. They are in general distinctly pointed out by the vacuities which the action of the sea has caused. The water gradually insinuates itself, not only between the walls of the veins and the body of rock, but among the transverse rifts of the veins themselves, detaching them in masses which the waves wash away, leaving open rents and semi-cavernous appearances. These veins vary from three to six feet in thickness, and are generally in an upright position, but affect no particular direction. It is not difficult to pursue their ramifications, which penetrate the adjacent rock, often to a considerable distance, producing the appearances already described in speaking of Barra. It will hereafter be seen that this phenomenon occurs in many other islands in this chain.

I may here add that as Wia, Fladda, and the smaller neighbouring islands, perfectly resemble these, as well as Barra, in structure, it is superfluous to make further mention of them.

SOUTH UIST.*

This island, the most extensive of the group which constitutes the southern half of the exterior chain, is separated from Barra by the islands of Fudia, Eriska, and some smaller ones, and by a sound interspersed with sunk rocks. Excepting the sound of Harris this is the only one throughout the whole chain which affords passage to ships, but it is dreaded by mariners even more than that strait, on account of the distance to which the dangerous ground extends westward. From Benbecula at its northern extremity it is also separated by a shallow strait interspersed with rocks and flat islands, intricate beyond description. The retiring tide leaves a bar of sand which is so nearly uncovered at low water, as to admit of a communication between the two islands. On the eastern side the coast is rocky throughout, although scarcely ever precipitous, and the water is deep, with a clean shore. On the western it presents one uniform flat shore of sand free from outlying rocks.

The total length of South Uist is twenty miles and its greatest breadth about nine. It may readily be divided into two nearly equal portions, by an imaginary but irregular line extending north and south. The western half affords no subjects for the mineralogist, presenting one uniform alluvial flat of peat, interspersed with numerous lakes and skirted toward the shore with sand. The eastern division is mountainous and rocky, and is intersected by sea lochs which enter far inland, winding about in the most sinuous directions, and covered with rocky islands. The mountains which form the eastern side of South Uist cannot be said to constitute a chain; they rather form three distinct groups. That which lies between Loch Boisdale and Kilbride consists of three or four somewhat distinct and rounded eminences scarcely rising to the altitude of a thousand feet. They do not here extend far westward, since this lake in its ulterior ramifications reaches into the flat country. From Loch Boisdale to Loch Eynort the hills rise to an altitude more considerable and extend further westward; enclosing the head of this lake, which nevertheless is protracted like the former into numerous intricate and involved channels, separated by rocky eminences and occupying beautifully sequestered valleys, now barren and deserted, but susceptible under a more favourable climate of every variety of picturesque ornament. To the north of Loch Eynort the hills still rise in elevation, forming a conspicuous ridge that is seen far at sea and occupies a considerable portion of the island. This ridge gradually declines by a long slope into Loch Skiport. Its highest elevation is Hecla, resembling however in no other respect but appellation, its very celebrated namesake. A storm of wind and rain prevented me from observing its barometric altitude, but it is probably not much short of 3000 feet. The faces of these hills are all covered with rocky protuberances, rounded and independently scattered, as the gneiss rocks in this country most commonly are. The summit of Hecla alone presents some abrupt and broken faces, but they are of small dimensions. At Loch Skiport the hills disappear, and are succeeded by a group of low rocky islands and promontories which checquer and diversify the intricate mixture of land and water by which South Uist is separated from Benbecula. Loch Skiport penetrates so far to the west, but with a change of name to Loch Gamoslechan, that it reaches the western sea, and thus separates a portion of South Uist in the form of a low flat island, which is not however distinguished by a separate appellation.

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* Uist; corrupted from Vest (Danish) the west island. For this and the remainder of the Long Island it is necessary that the reader should consult the general Map, as the nearly uniform geological structure of the whole chain renders detailed ones unnecessary.

EXCEPT the great tract of peat which I have described, and the minor patches of sand found on the western shore, there appears to be no alluvium in South Uist. The only detached stones to be found, are fragments of the gneiss of which the country consists, and these are rarely marked by the signs of attrition which indicate either a distant period of separation or a long-continued state of motion. The western side of the island is, however, subject to considerable alterations in its figure and dimensions from the shifting of the sands of which it is principally formed. This is a phenomenon common to almost the whole western side of the Long Isle, from Barra Head to Loch Tarbet in Harris. I have already mentioned its occurrence in Barra and the southern isles, but as I shall have occasion to examine it hereafter when describing North Uist, I forbear to dwell on it here.

The lakes that occupy the flat soil on the western side of the island, neither receive nor give exit to any streams. They are generally shallow, often not exceeding two or three feet in depth, and appear to be the mere repositories of that drainage from the surface to which a country like this must be subject. Their waters are invariably brown, from a considerable solution of peat. The whole island is indeed destitute of streams, since the ephemeral torrents, of which a few can be traced flowing down some of the declivities during a heavy fall of rain, scarcely deserve that name. They vanish as they arose, since they are not supplied by springs, not one of which has I believe been observed. This want of springs must be attributed, as in Barra, to the nature of the rock, which presents neither receptacles for water nor fissures for its transmission. At the same time it must be remarked that the climate is far from rainy, the clouds, which generally pass the sea with rapidity, meeting no material obstacle until they arrive at the continental land of Scotland. Hecla indeed, and the mountains about Loch Eynort, are, in consequence of their height, subject to many showers from which the remainder of the island is exempt.

With a general resemblance to Barra in the nature and disposition of its surface, considered as a subject of agriculture, South Uist presents some differences. The belt of sand on the west is more continuous and better defined, while the middle region is a tract of moory flat ground separating the sandy soil from the mountainous district.

The sandy region presents a most desolate appearance when the crops are removed and it has assumed its winter dress; but, like Coll, it is enlivened in spring with a profusion of clover and other wild flowers, which give it an aspect of cheerfulness and a brilliancy of colour to be found no where but on the sandy tracts of these islands. Barley, oats, rye, and potatoes, are cultivated throughout the whole, by the assistance of sea-weed and the ordinary manures.* Portions of the middle tract are also in cultivation where the ground is firm and naturally drained by means of the lakes which are scattered in profusion throughout it: the remainder is a gloomy extent of black peat, but like the middle soils of these islands in general, is undergoing a gradual amelioration from the diffusion of the blowing sand along its surface. Beyond this tract towards the east, the ground rises into low subsidiary hills skirting the higher mountains. These are deeply covered with peat, which is however, like the middle district, naturally drained by means of cuts produced from the flowing of the surface waters; and they are thus rendered capable of cultivation, holding out at present the chief temptation to general and lasting improvements.

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* There is a sort of cultivation occasionally seen on the sea-shores of the Highlands at which a stranger will be much surprised. Sea-weed is strewed on the shingle above the high-water mark, and on it is sown barley (bear). As it disappears during the growth of the corn, the crop is in harvest time seen covering a surface of pure rounded pebbles of quartz or granite without a vestige of soil.

The mountainous district is not highly productive of pasture, and is principally, perhaps not most profitably, applied to the rearing of black cattle. This appropriation of the mountain pastures of the Long Island is however to a certain extent unavoidable, as the difficulty of transporting sheep to the main land is, from the length of the voyage, so considerable as materially to discourage that branch of pasturage.

The want of roads is a serious obstacle to the improvement of this island, which is peculiarly difficult to traverse in any direction. The introduction of these would form the first step to improvement. A few feeble attempts to plant trees have been made, but they have been attended with little success: the whole appears a naked and dreary waste.

THE reader is doubtless prepared to find that the rocks of this island consist of gneiss: such is the fact, while they afford scarcely any varieties to interest him after what has already been remarked of the southern islands.

Still, there is a change of character, the gneiss being here almost uniformly of a granitic aspect, or this variety being at least predominant. The external forms are indeed so like those of granite, as, at first sight, almost to mislead an observer. In the internal structure it also approaches very near to that rock, although there is always to be observed somewhere an indication of the foliated tendency. I must here remark, for the sake of those who may be little conversant with rocks in their natural positions, that specimens may frequently be obtained from beds of gneiss, undistinguishable from genuine granite. It is true that they may sometimes be portions of granite veins, but in other cases they constitute real integrant parts of the gneiss beds. However proper therefore it may be to consider them as granite when viewed as cabinet specimens, it is still necessary that they should be arranged as parts of a gneiss series. The views of the geologist embracing a wide field must not be limited by variations which are minute, irregular, and inconstant, and which do not affect the broader principles that regulate his investigations. This remark is applicable to many other cases where occasional variations of small extent and importance take place, and where specimens of a distinct rock will intrude into a class otherwise geologically very consistent and strongly defined. Such accidents may perhaps be considered in the same light as the formation of independent minerals in similar situations, and they require attention, lest from an occasional specimen of such anomalous or accidental rocks, the character of a whole district should be mistaken.

From Kilbride to Loch Boisdale the position of the gneiss is extremely irregular. It occasionally contains irregular lumps of garnet of an intense brownish black colour, with a vitreous lustre and smooth conchoidal fracture. Although so much resembling granite about Kilbride, it resumes the more common foliated character as it approaches the shores of Loch Boisdale; abounding in hornblende, and containing distinct portions of hornblende schist and of common hornblende rock. Few granite veins seem to exist throughout this tract; where they occur, they sometimes possess the graphic character.*

From Loch Boisdale to Loch Eynort the hills descend gradually into the sea, but on the right hand of the entrance an abrupt face of cliff is seen of about 100 feet in elevation, tenanted by cormorants and rock pigeons. The external features of these cliffs indicate a difference in their structure and in the nature of the rocks. They exhibit on close examination the same appearances which in a more limited manner occur in Barra, Gia, and Hellesa. Here the magnitude of the trap veins and the extent of surface exposed render the junction more extensive and the disturbance much more striking. I have already detailed the nature of these junctions so minutely that it is unnecessary to repeat it. But in this place may be seen very perfectly the conglomerated nature of portions of the trap vein. This is a matter of considerable difficulty to explain, since, as far as I yet know, the trap conglomerates have been invariably found forming portions of masses, or else entire beds. The conglomerated substance consists in some places of fragments of trap imbedded in a trap basis, while in others the imbedded masses are of gneiss and granite. As the cliffs are of very difficult access, I do not speak very decidedly respecting the latter variety, as it may be a fallacy arising from the intermixture of fragments of the original rock with minute reticulating veins. The basalt of this vein acquires by the action of the sea on its surface a dark green colour. Where it has been subjected to atmospheric action only, it is cavernous and scoriform, resembling very much some varieties of iron slag; and it is invested with a black sooty powder in those cavities which are protected from the rain.

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* The remains of a castle are visible at the entrance of Loch Boisdale, but so far ruined that little more than the foundation exists. This country indeed is as uninteresting to the antiquary as to the lover of natural beauties; offering little or nothing for the gratification of either. That which is rude is not grand, and that which is intricate is but rarely picturesque.

The bottoms of these cliffs are coated with spongia papillaris, and various other marine productions.

All the hills which skirt Loch Eynort are of gneiss, and among them the varieties which contain hornblende predominate. Its disposition is equally irregular as at Loch Boisdale, and veins of granite are equally rare. Among them are seen concretions of a very dark grey felspar, and similarly large ones of common hornblende. Quartz is of rare occurrence. Nothing indeed can be imagined more tiresome to a geologist than the perpetual and almost unvarying recurrence of gneiss, which forms the lowest as it rises to the highest parts of this cheerless country. The same rock continues to occupy the remainder of the group from Loch Eynort to Loch Skiport, including Hecla; the only substances capable of attracting attention appearing to exist in the granite veins, which present uncommon and beautiful mixtures of grey and black quartz with white felspar.

Of the innumerable islands which are found in Loch Skiport and in Kyleslewsa, interposed between South Uist and Benbecula, I examined only a few. They all appear to be portions of the same rock which constitutes the rest of the country, among the protuberances of which the water insinuating itself, has generated a multitudinous archipelago, which no patience could investigate, unless under greater temptations than those presented by gneiss. The similarity in the structure of Benbecula, next to be described, adds a sufficient confirmation of the truth of this conjecture.

BENBECULA.

THIS island is seven miles in length and eight in breadth, being of an oval shape. Although divided by a channel from the north end of South Uist, it is, in a general view, undistinguishable, the division produced by that channel being so intricate and narrow as to be often invisible. The island of Wia placed at its south-eastern extremity, and that of Grimsa, which lies in the strait that separates it from North Uist, may also in a physical view be conceived to appertain to it, as they present the same aspect and are constituted of the same rocks; while that of Rona, equally near with Grimsa, will be found both in character and composition to form a part of North Uist. Sundry small islets and rocks are scattered about its eastern side, and in each of the north and south channels which separate it from the neighbouring islands. These partake in their nature of the approximate shores, with one exception which I shall point out in its proper place.

The eastern side of the island, and the eastern portions of the northern and southern boundaries, are characterized by those tortuous and intricate indentations of the shores which occur in South Uist. But they far exceed these in their capricious sinuosities; forming a labyrinth from which a stranger, attempting to move among them whether by land or water, is unable to extricate himself. Of these indentations, Loch Uskevagh is the most remarkable, occupying a space of ten or twelve miles in circumference, in which the land and water are dispersed among each other in such equal proportions and such minute divisions, that it is difficult to say which predominates. The visitor who attempts to explore it is unexpectedly surprised by the occurrence of new channels and fresh headlands when he had imagined himself at the end of his voyage; and in the multiplicity of islands and promontories which open and shut upon him on all hands, loses the recollection of his place, and the clue to his return. Surprising and pleasing as this scenery is, it offers nothing picturesque, from the almost absolute identity of the parts and the lowness of the land; which consequently possesses no features adapted to landscape, void as it is of trees and of discriminating objects. Nature may be truly said to have here wasted her capabilities on a climate to which she has refused vegetation, nay almost denied a soil. The imagination may paint these watery regions situated in a fine climate with sunny skies, adorned with trees, decked with flowers, and embellished with works of art; and may, with Mirza, in its dreams transport itself to the flowery islands of the blessed. But the spectator soon rouses himself from his trance, and sees grey rocks covered with brown heath, and shores deformed with sea-weeds, among which a rising and falling tide alternately conceals and exposes a bottom of dark ooze.

The western side of Benbecula is bounded by a flat sandy shore, and, except one large indentation, presents a sea line comparatively even. Lower in level it cannot well be, since the land scarcely rises any where twelve feet above the high water mark; but it is freer from rocks than the eastern, and presents therefore a more uniform flat. The sand which forms part of this western shore extends to the north and south channels, producing bars called the north and south strands, which the retiring tide leaves nearly dry, so as to present fords of communication between the islands. The interior land, which in a general view is of a flat aspect, is interspersed with low rocks and irregular eminences not exceeding a few feet in height. Its eastern half is almost entirely covered with peat, on which scarcely any vegetables grow but Erica tetralix, starved plants of Erica vulgaris, and a few of the moory grasses; the greater part exposing the naked brown surface and being intersected with numerous soft bogs. In summer it is difficult to cross it, in winter it must be impassable. The western division exhibits a better soil, being more sandy and affording in consequence a verdant surface, dry and convertible to agriculture. The whole of this surface is chequered by a profusion of fresh water lakes, which wind among the rocks, and together with the indentations of the sea, give to the whole island a most singular aspect. I attempted in vain to number them from Benbecula hill, but after reaching to ninety was obliged to abandon the dazzling pursuit. This hill is the only one which the island possesses. It is a roundish extended mass, and appears to be between 600 and 700 feet in height. From its summit a very extraordinary view presents itself, the whole of the island beneath detailed as in a map, and the southern and northern islands extending to an undefined length with all their mottled plains and scattered mountains; while the more eastern lands of Sky and Rum, with the adjacent continent, are distinctly visible in the horizon.

After the remarks already made on the subject of water in describing the preceding islands, it is unnecessary to say that Benbecula possesses no running stream, of which indeed its flat surface is a sufficient indication. The lakes with which it abounds appear to be merely receptacles of rain water, varying in depth from six inches to as many feet, and all highly tinctured with peat. All the lakes of these islands abound with trout, and produce many of the alpine aquatics. In this I remarked abundance of the Ranunculus lingua, and R. gramineus, plants not very common in Scotland. The sea lochs and indentations abound also in those sea-weeds, from the produce of which converted into kelp a principal part of the value of this, as of the other islands, arises. This manufacture affords occupation for numbers, and the labour employed in it is the common substitute for rent, as I shall have occasion to notice hereafter.

There are no changes of the surface in action on the eastern side of Benbecula, if we except the gradual and constant accumulation of peat. But on the western side the blowing of the sand produces an annual extension of the shore. The inhabitants even talk of a period within their memory, at which Castle Wia, now a mile from the sea, was surrounded by water. This phenomenon, already noticed in these islands, is the reverse of those changes to which land is in ordinary cases subjected. Accumulations of soil and extensions of the sea shore at the mouths of rivers are not uncommon, and the addition is in these cases made by the waste and transportation of the higher land, of which a portion is also carried to sea and deposited at its bottom, gradually diminishing its depth, and probably laying the foundations of future stratified rocks. In this case on the contrary, the opposite effect takes place; the deposits generated at the bottom of the sea by the constant destruction of shells, being driven towards the shore by the action of the waves and ultimately dispersed by winds over the land; where, with the assistance of plants, they at length become a permanent addition to the soil, extending the coast and causing the sea line to retire.

BENBECULA, like Barra and other parts of this outer chain, affords one of the most striking examples of that redundancy of population for which the Highlands have in many places been so frequently remarked. It is a question too interesting to be passed over in absolute silence, although a very slight notice alone of this and similar subjects is compatible with the design of this work. It has hitherto been discussed with much warmth, in consequence of its connexion with many interests; the judgment of an uninterested person, although perhaps less competent to treat it, will at any rate be unbiassed. But we must not stumble at the threshold of the argument. A population is redundant, whatever be its absolute numbers, where the labourers, whether, as here, in the shape of kelp makers, of farmers, or of fishermen, are without sufficient employment, and where without an increase of it they are unable to command a fair proportion of the necessaries of life. No one who is acquainted with this country can doubt the fact itself, as far as relates to the means of living, which are not the less deficient because the deficiency is universal. Riches and poverty to a certain extent may be relative, but there is a point at which poverty is absolute, and where it does not cease to be an evil although divested of those additional grievances which are the result of a comparison with superior wealth.* When therefore it is asserted that the population is not now redundant, because it was equally supposed to be redundant thirty years ago, and has yet materially increased within that period, nothing is proved but that the means of living, which are the result of an additional quantity of productive labour and of a cause still more obvious, the introduction of the potatoe, have themselves increased. Although a nice equipoise of the two, similar to that which existed at the commencement of the process, may not have been preserved at all times, yet under certain slight fluctuations, the population and the produce have held a common pace together. No parallel can in a case of this nature be nicely consistent throughout, and accordingly the demand has in many instances outstripped the supply, and the excess of population has been felt at various times in the want of farms to cultivate, of labour to perform, and consequently, of the means of living. At others doubtless, the supply has exceeded the demand, as must sometimes necessarily happen, and thus the contradictory statements of different observers, too much generalized but equally founded on facts, are to be reconciled. If the only statements we can command are to be relied on, the actual population of the Isles appear to have been nearly doubled in the last sixty years. It is indifferent for the present purpose whether this statement be very precise or not. The existence of frequent scarcity or of absolute famine during the early parts of this period, but chiefly before it, are a sufficient proof of redundant population in those times. There have been no instances of famine recently, for even the great increase of population has been exceeded in rapidity by that of the means of living.* The redundancy is unquestionably much less than formerly, but it still exists, and must necessarily under the present circumstances of these islands proceed in a constant increase till it reaches the same limit which it touched sixty years ago. Where that limit may be placed we cannot tell, but it is evident that wherever so near a race is run on this ground, an interference must occasionally occur, or those inconveniences arising from occasional excess of population must take place, of which Benbecula among other districts presents an example.

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* Though the poverty of the people is here so great, we must beware of attaching to the term the debasing ideas with which it is associated in England. It is not at variance with the numerous moral and physical virtues that strongly characterize the Highlanders. The reader will probably recollect a parallel distinction which Montésquieu has drawn on this subject.

A consideration of the nature of this argument as far as relates to the past is sufficient for illustrating it as to the future. It is contended that no removal of the people is necessary, because the means of living are increasing in proportion to their additional numbers.

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* Although this is true in a general sense, it must not be too strictly taken, as the inhabitants, both of the islands and the western coast, whose means are at present but barely calculated to meet their consumption, occasionally suffer great privations on any check to their harvest or to the expected produce of their fishery. The last year (1817) was peculiarly marked by an interval between the consumption of the old crop and the ripening of the new one, attended with distress approaching to famine. In Sutherland numerous families subsisted on fish alone, often on shell fish, for near two months, neither meal nor potatoes remaining. At length, although the coast abounded with fish, the men were so enfeebled that they were unable to row their boats out to the fishery, and many were confined to their beds from the consequences of exhaustion.

But the point of distress having once arrived, it is impossible to wait for the tedious operations by which it is to be remedied, as it ultimately may, since the demand for relief is imperious, and to withhold it when it can be given is cruelty. The redundancy must be removed if possible, by diverting it to those places where there may be a demand for labour; and to argue against the propriety of this measure, admitting it to be practicable, is a proceeding as distant from good policy as from humanity. The criterion by which the excess of population in Benbecula may be judged of, without having recourse to the insufficient helps of numerical investigation, consists as much in the minute division of farms, as in the low price of labour. The state of the kelp manufacture is a sufficient proof of this latter fact, it being conducted at a much lower price than in the neighbouring districts. The comparative poverty of the inhabitants corresponds, and, as is usual in similar cases, ill-founded complaints prevail, of oppression on the part of the proprietor in the exaction of so large a portion of labour for the occupation of tenements so small. We cannot expect juster views of political economy among these wretched inhabitants than we find among their betters; and it is in vain to remind them that even the unconditional surrender of the whole land would in a short time leave them as poor as they now are. Under this pressure their attachment to the soil is insuperable; no consideration appearing to have any power to induce the wish for a change of place, though even far short of actual emigration. It is sufficiently difficult to effect such a change of place even in more common circumstances, since "Man" it has been well observed, "is of all lumber the most difficult to move," but the degree of attachment here, and generally throughout the country, is such, that scarcely any considerations are able to overcome it. There is in this case however as in many others, an apparent contradiction, since there has been a time when the inhabitants' of the Long Isle were noted for their propensity to emigration, and when considerable numbers removed to America. But these emigrations seem to have been the result of a contagious or sympathetic feeling in particular tracts. It has always been difficult to remove individuals or single families, yet occasionally whole tracts have emigrated together, to the no small terror of many patriotic individuals, whose political knowledge was less commendable than the goodness of their intentions. This taste is however at present dormant; but I shall have occasion to consider the subject again.

It is maintained by many persons that emigration is never necessary: it is even said that no migration from any individual island or estate is ever requisite, and that employment may be found in the cultivation of fresh lands and in manufactures. I must postpone the question of manufactures, although they form an expedient the futility of which is easily shown. Benbecula might perhaps dispose of a portion of its present excess of population on its own lands, as well as might South Uist; but it must be under a mode of management very different from the present. Let us however examine the same question as it relates to Barra and to North Uist.

The arable land of Barra bears a small proportion to its pastures, and it may, I believe, be safely stated, that every thing arable or capable of permanent improvement is already in a state of cultivation. In any other circumstances indeed, the cultivation of Barra would be judged excessive and injudicious. A change of system, such as in many instances might be productive of advantage, would therefore in Barra only tend to diminish the number of occupants, by diminishing both the quantity of produce capable of being immediately consumed on the soil, and the labour required for the cultivation of that land which ought to be maintained in agriculture. In the present state of the island moreover, a large proportion of the population is supported by the produce of a very active fishery, as I have already shown. Could this fishery be indefinitely increased there would of course be no limit to the increase of population. But this cannot be done precisely as it is required to meet the additional demand for employment and food; perhaps it cannot be done at all. In the mean time the people of Barra have exceeded the demand for this and every other employment, and have entirely occupied all the land capable of cultivation. They are therefore redundant, and as a sufficient practical proof of such redundancy, it is only necessary to state that there is a considerable village at Kilbar for which no land is to be found; land, which in a country without markets, forms so indispensable a requisite in the economy of a Highland family. A single acre has by the humanity of the proprietor been given to this community for the cultivation of their potatoes, and a wretched existence is thus worn out by them, partly by this resource, partly by the fishery in which the men are engaged; both of which being insufficient, the women and children are constantly employed in digging cockles on the sandy shores, offering a spectacle of poverty which is painful even in this country where it is daily seen in all its modifications.

The case of North Uist, which I shall introduce here for the purpose of bringing the whole evidence under one collective point of view, is of a different nature, but equally instructive.

I need not describe at large the beneficial change which has taken place in many parts of the Highlands by the alteration in the mode of letting farms, since it is now generally known. It is sufficient to say that but few instances remain of the ancient mode of tenure in common, or by run-rig; the separation of each common farm into separate crofts or holdings having been adopted by most proprietors, and with evident advantages to all parties. In consequence of this system in some measure, but partly also from the assignment of new lands to many of these crofters, accommodation has been found on the main land in many instances for a much greater number of people than before; while a great deal of fresh land has been brought in, from the new stimulus given to the industry of the people by the possession of an independent kind of property, instead of a lax interest in a joint and often-changing lot. In consequence of this arrangement, it has happened that large tracts have been thrown into sheep farms, with little difficulty or distress from the removal of the ancient tenants, while the produce of the estate and the proprietor's revenue have been materially increased. But cases have also occurred, where the crowd which occupied the common farms of an estate, have been too numerous to admit of a separate lot of sufficient extent being assigned to each, and here the excess of population has been brought to light by the very same practices which have in other instances caused it to be absorbed in the acquisition of new employment. This event has taken place in North Uist, and to those who are acquainted with the humanity and intelligence with which that estate has been conducted and divided, it will be unnecessary to say that no precaution has been omitted to prevent the evils which have followed. Yet, an hundred families, containing about five times that number of individuals, have been dispossessed, and are now without land, and from the nature of things under the Highland system, with very insufficient employment. A great proportion of that number may fairly be considered as redundant, and there is no doubt that their own interests as well as that of the proprietor requires their removal. Hereafter it is possible, that the changes to be expected in the improvement of the land from the adoption of the new system, may be able to absorb this population or even more; at present a remedy is wanted for the excess. It may be asked, how the same people were accommodated with land before the division, and the question is easily answered. Under the ancient common holdings where no man's lot was defined, no just idea was entertained of the limits of the land or of its value. Thus, a farm let to ten or twenty tenants readily accommodated two or three more, the surrender requisite for these superfluous hands being such that no one felt his particular share of the sacrifice. In this way every farm was encumbered with two or three idle and gratuitous retainers, who, from the claims of kindred or other causes, were allowed to drag on in this way a miserable existence. At present the lot of an individual admits of no such lax charity, and those who have been ejected are thus driven to a mingled state of insufficient labour and beggary.

The state of things here described is not limited to the outer islands only. Rum, among others, furnishes an example of a similar evil, where the chief part of the burden has however been hitherto borne by the proprietor. But it is not necessary to go into details of facts sufficiently known to all those who are acquainted with these islands, however they may have been doubted or denied by others whose opinions were formed on a partial knowledge of the country. As far as the proprietors are concerned, it is an act of palpable injustice to expect from them the total sacrifice of their properties, independently of the evil which the community in general must suffer from the imperfect state of management to which their lands must under such circumstances be necessarily condemned; particularly as the remedy is far from adequate, and can at the best but remove the day of change and reckoning to a somewhat greater distance. The change will in fact be the more severe the longer it is protracted, since greater numbers will be added to greater poverty.

The Englishman, to whom the habits and feelings of this people are unknown, will be surprised that such a state of things can exist at all, and not less so to find that it is difficult to apply a remedy. He expects that the natural overflowing of people in one place, will without effort discharge its superfluity on those where there is a deficiency. He is unacquainted with the pertinacity with which the Highlanders adhere to their place of birth, and that, it would seem, exactly in the inverse ratio of all apparent causes of attraction. At the same time it must be remarked, that the insulated state, the peculiar habits, and the language of these people present additional obstacles to migration; and that many changes, yet far distant, must be made before such a free communication can be established as shall allow it to take place without effort and without pain; before it shall become a current part of the system of action. Any expedients which shall break through these habits and destroy these bounds, will facilitate this measure so much to be wished, and by abolishing distinctions in the community at large, render the interchange of all its constituent parts easy. A common standard of pursuits, occupation, language, manners, and wants once established, would remove these obstacles; but an examination of the several means by which this may ultimately be effected would lead into a chain of discussion far beyond the bounds to which I am limited in this very general sketch of the economy of these islands. It is sufficient to have thrown out these hints on the eventual remedies. It will be seen that much may perhaps be done by methods which, although apparently not leading directly to the wished for alterations, will facilitate and hasten them. The views thus held out, of the facility with which an occasional migration, adequate to meet the varying demands for population in different districts will take place when the total system of the country shall have been changed, are abundantly exemplified in Isla. Here the change is nearly completed, labour has found its level, and no difficulties are experienced either in commanding an additional population when wanted, or in rejecting it whenever fresh arrangements in the divisions of land and the improvements of farming, render it an incumbrance.

Thus far I have only looked to the general circumstance of migration, and after the numerous and often intemperate debates which have existed on the subject of emigration, I would willingly pass it without notice lest I should entangle myself among the host of contending adversaries. The unfortunate connexion which subsists between certain terms and the concatenated trains of prejudices or feelings which they excite, is such, that it is difficult to render the simplest truth acceptable where these are called into use. If we could banish the words emigration, depopulation, engrossing of farms, and some others equally offensive, from these discussions, they would be attended with comparatively little difficulty: to divest these terms of their odious attributes is impossible. Yet it is plain to every one in the least familiar with the principles of political economy, that the evils arising from emigration are almost in every instance imaginary, and that to oppose it where there is such a tendency, while it is an evil to the community at large, is no less a grievance to the individuals who would resort to that remedy, than a forcible deportation would be to those who were inclined to stay. It is not too much to add, that the individual, or the government, which protects the liberty of the subject in all the arrangements best adapted both for his own and for the general welfare, is only extending the exercise of its protection when it facilitates such measures by removing the artificial or natural impediments that stand in its way. The subject of depopulation is too trite, and the popular terror respecting its evil consequences too groundless, to deserve notice. But I must pass from a subject too interesting for the space which I can afford for it. In the mean time no great difficulty seems to exist in reconciling the apparently discordant opinions of those who have adopted different sides in this much agitated question. The evils that resulted from the change in the state of the Highlands which followed the events of 1745 and the subsequent introduction of sheep farming into many districts, undoubtedly found a relief by emigration, and then justified its utility. But on the one side it appears to have been looked to as the only remedy, while on the other it was maintained to be always unnecessary, and at the same time deemed politically inexpedient. The objection of political inexpediency must be given up by its supporters; yet it must at the same time be admitted, as abundant experience has since shown, that the process of crofting on new lands, ameliorations in agriculture, and above all the extended use and cultivation of the potatoe, have proved that many remedies besides emigration were capable of being applied, and of absorbing that population which was rapidly augmenting, and always trenching on the very verge (to say no less) of redundance. But the views of the partizans of these expedients were not sufficiently penetrating, and the instances adduced above are sufficient to show that the disease has advanced more rapidly than this class of remedies has been provided to cope with it, and thus the question in favour of occasional emigration is determined. The fault has been one too common in argument, that neither party has been inclined to yield enough to its antagonist*. I shall not be suspected of quoting Voltaire as an authority in political economy, but the subjoined passage is not inapplicable to the subject.*

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* It will be easily perceived that I here allude to the numerous writings which followed the able essay of my noble friend the Earl of Selkirk. To the general principles laid down in that work we are indebted for the greater correctness of thinking which has lately been introduced into this branch of our political economy. But enough power was not granted in it to the system of removal, crofting, and general improvement. His opponents on the other hand have attributed too much to its efficacy, and have supposed it to afford a perpetual remedy for all future accumulation of people; while they have made the subject a source of controversy in a manner unfitting that which peculiarly requires calm and temperate discussion.

There is yet another question connected with the state of the insular population, of a political nature and of no small importance; arising from the nature of the present tenures and the extreme division of farms in the unimproved islands. This seems limited to a narrow space as a question of government, and had this radical and proper basis of the argument so often and so acrimoniously contested among the numerous disputants, been sufficiently regarded, less time would have been occupied by the controversy. There is no doubt that the population of any country like this will be greater under such a system than under one which shall convert many small pastoral farms into a large one, or which, by uniting in a similar manner the small arable farms, shall dispense with the numerous incumbents who under such an improved system would find no employment on the soil. But in these cases the same quantity of the given manufacture, cattle or corn, is produced by fewer hands, or the agricultural machine is more perfect. And as the perfection of agriculture, as of manufactures, is that state in which the greatest produce is obtained at the least expense, it would be difficult to admit the principle that this perfection in the first of all arts was advantageous in a general view, while in the details it was injurious. Where each cultivator can only produce sufficient for his own maintenance he can pay no rent: where he can produce but little more he can pay but little rent, and thus rent is in some measure the criterion of agricultural improvement. But where he produces no more than he consumes there is no surplus produce;

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* "Dans çe cas il faudroit que la terre rendit le double de çe qu'elle rend, ou qu'il y auroit le double de pauvres, ou qu'il faudroit avoir le double sur l'étranger, ou envoyer la moitié de la nation en Amerique, ou que la moitié de la nation mangeât l'autre."

and in this case there can be no surplus population; no army, none of all the classes which constitute the efficient parts of a state. Here then is the basis of the argument as far as it respects this question. It is true that the individuals living under such a system may be very innocent, and very contented, but the collective society cannot exist on these terms, and it is equally plain that whatever portion of it is in that condition, is, for the general purposes of the whole, useless. Since it can furnish no food, it can supply no members for that part of the society which is the bond and security of the whole, that which governs, thinks, and defends. Where this state also exists, the limit to population must consist in distress or in absolute want, since no one will change his place from any other motive; and thus the change of place is preceded or attended by a state of poverty or inconvenience giving to the emigration that character of misery which has occurred so often that the idea of distress is necessarily connected with the word, and in the minds of the mass who are not accustomed to examine the associations of their ideas, appears to be a result of it.

Dismissing this subject, which would otherwise ramify into digressions inconsistent with the nature of this work, it is interesting to examine whether the agricultural condition of the Highland districts in question is not a practical illustration of the political principle just mentioned, namely, that such a state admits of no surplus population; this being the great point as far as government, or the general benefit of the whole empire is concerned. Like many other popular opinions, repeated without examination because once asserted, the Highlands, and these islands among them, are represented as a nursery of seamen and soldiers. Montesquieu has well remarked "Qu'il y a des choses que tout le monde dit parce qu'ils ont été dites une fois." It is said even in recent writings, that the islands furnish some thousands of soldiers to the service, and the statement is always adorned with an eulogium on the military character and the military propensities of the natives. The character of those who are soldiers admits of no question, but it must not be made use of to cover an unfounded assertion respecting their military propensities. They are every where notedly averse to the army, and I do not say without abundant information that it probably would be impossible to raise a single recruit by beat of drum, or a single volunteer for the navy, throughout the islands; more particularly in those where the population is the most crowded and most needy; in other words where the ancient habits are most prevalent. It is doubtful if the whole of the islands possess at this moment an hundred men in both services. Sky with a population of at least 16,000 has not a man in the army. The same is true of Arran, less remote yet equally under the influence of the ancient system.* It is not here meant that the effectual demand for labour in the islands is such as to prevent any part of the population from being removed for military service without detriment to the agriculture. Far from it, but the practical result is the same, and it arises from the divided and universal possession of land. Recruits are never easily obtained from agricultural labourers, for reasons well known, and still less can they be procured among those who are the possessors or the occupiers of land, be those occupancies ever so small. If recruits should be raised in the islands they would be found in Isla, not in Sky, nor in the Long Island. This is a condition of society in which military conscription becomes, in cases of need, imperious, since no other mode of forming an army remains; and the example of France, in which so large a portion of the land became occupied in a similar manner in consequence of the revolution and its events, while it illustrates the present case, justifies the necessity of the measures there adopted.

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* Since this was written the agricultural system of Arran has been changed. — 1818.

It may truly be said that the population of 60,000 Highland insulars, which according to the ordinary average of European military supply would have afforded 600 soldiers, was defended during the late war by the artisans and manufacturers of England and the low country. The adoption of means to diffuse the spirit of military and naval service throughout these islands would in many respects confer a decided benefit upon them; not only by affording an useful drain on the population, but by making an inroad on many of those habits which are the groundwork of the evils enumerated. At the same time, the return of disbanded men would have the effect of introducing improvements, which on so many occasions have been the result of similar circumstances. To inquire why this is not done, would be to inquire why so much of that which relates to the improvement, the police, and the general welfare of these islands has been neglected. But it is time to return to the physical history of Benbecula.

As I have already remarked that the islands of Grimsa and Wia resemble Benbecula in every respect, it is unnecessary to give any further description of them. That of the one will serve for the whole, as well in the general as in the geological characters. I may only observe, that some parts of the shore of Grimsa exhibit beds of gneiss of extreme tenuity, micaceous, and capable of being detached in thin leaves.

The whole composition of Benbecula is identical, and consists entirely of gneiss, forming in reality a continuation of the rocks of South Uist. This gneiss is found occupying the whole of Benbecula hill, as well as almost all the coasts and islands that I examined, and all the protuberances which are scattered over the face of the country. The only exception will be noticed immediately. Its character is as various as that of South Uist and Barra, and it would be difficult to say that any one modification was predominant. In one instance only I perceived a rock traversed by minutely ramifying veins of trap, of a compact basaltic nature like those before described. The hornblende schist which appears, in a geological sense, to belong to this rock, is found in very distinct forms, and a bed of it on the summit of Benbecula hill abounds in garnets. Some specimens are also characterized by containing greenish foliated talc.

The exception above noticed is the following. At the entrance of Loch Kyleswiaveg are some islands composed of a schistose rock of a very peculiar character. It appears at first sight to be an intermixture of common blue argillaceous schist with grains of quartz and compact felspar; a more minute examination proves it to be an irregular and very anomalous compound. But as this rock forms an important feature of the adjacent land of North Uist, and will require to be more fully considered hereafter, I shall defer any further notice of it at present; remarking only, that it may possibly occupy some more of the outstanding islands, or skirt some of the shores which I could not inspect.

NORTH UIST.

THIS island is the northernmost of that division of the Long Island which is made by the sound of Harris; bearing at the same time many physical marks by which it is distinguished from the remainder of the chain northwards. It is of an irregularly rounded triangular shape, its greatest length being sixteen miles, and its greatest breadth about thirteen. It is separated from Benbecula by a narrow, complicated, and shallow strait beset with innumerable islands, similar to that by which Benbecula is divided from South Uist. This strait affords passage for small boats, but only at high water, the sand called the north strand being fordable at the ebb tide. The sound of Harris, which bounds it on the north side, is seven miles in breadth and crowded with islands and rocks; being passable by large ships, but not without the assistance of experienced pilots, there being no marks to point out this very intricate and dangerous channel. Some small islands skirt the western shore at different distances, but the eastern, as is usual in the Long Island, is abrupt and tolerably free from rocks and islands.

Retracing the general aspect of the islands already examined, it has been seen that the chain from Barra Head as far as the southern point of South Uist consisted of an irregular group of hills, occupying both the western and eastern shores, and occasionally intersected by small valleys. In South Uist the groups of hills occupy the eastern side exclusively, while the whole western division presents a level surface of peat, terminating to the west in sand. Benbecula presents an almost uniform flat surface, with the exception of one low hill, and the small elevation of Wia which may be reckoned as a constituent part of it. The surface of North Uist, although similar in its general character, is differently disposed. On its eastern side, towards the north and near Ba Chaas, it rises into a low ridge, which gradually increasing in elevation towards the southern end on the same side, terminates at Heval; this being the highest land in the island, and attaining, at the utmost, an elevation of 2000 feet. This chain is twice interrupted, namely by Loch Maddy, and by Loch Evort; but may be considered as continued in Rona, an island so exactly resembling North Uist as almost to preclude the necessity of a separate description. Proceeding westward from the ridge of Heval, a large flat presents itself, so perfectly similar to the eastern side of Benbecula that it is difficult to distinguish the one from the other. This tract, comprising nearly half the area of the island, is apparently so equally occupied by land and water that the eye can scarcely determine which of the two predominates. While the superior brilliancy of the watery surface would perhaps cause us to assign it the largest dimensions, measurement will I believe, determine in favour of the land. In point of value with respect to vegetable produce, it will be found that the difference is much in favour of the water. Such is the surface of the flat eastern land of North Uist; a brown, peaty, and boggy tract so interspersed with lakes and rocks as to be nearly impassable, and producing a scanty and wretched herbage for a few animals during the driest months of summer, while in the winter it is resigned to wild geese, ducks, and swans, who divide its waste and watery region with the sea gulls which the ocean can no longer protect or feed. The water which thus occupies the flat interior tract of North Uist, is principally formed by the ramifications of Loch Evort and Loch Maddy, together with those of minor extent which belong to Loch Macfail. Interspersed among these are numerous fresh water lakes and pools, of which some are inhabited by trout, and others, subject to occasional communication with the sea, are the temporary resort of salmon. The sinuosities of the sea lochs may be conceived from this statement; that while the whole of Loch Maddy is comprised within an area of nine square miles or less, its shores have been found by measurement to extend two hundred. These shores abound in those Fuci which are used in the making of kelp, the annual produce of this inlet alone being 300 tons. The cutting is chiefly triennial, and the quantity of sea weed required to produce this proportion of kelp is upwards of 7200 tons. Loch Evort covers a space nearly equal to that occupied by Loch Maddy, and its sinuosities are equally remarkable.

HAVING mentioned the kelp of Loch Maddy, I may extend the remarks on this manufacture for a few lines; since it is almost the only one which may be said to exist in the islands, and since its establishment, although but recent, has made so material an addition to the value of these estates, and to the demand for labour. The total produce of the Western islands in kelp varies from 5000 to 6000 tons, of which two thirds are the produce of the Long Island; the result of its highly indented shores, and of the consequent extent of surface, as well as of the superior tranquillity of the waters in which the plants grow. The variations in the price of this article, resulting from the varying competition of foreign commerce, are very considerable; and as the total expense of manufacture has been estimated on an average at £5 per ton, a considerable deduction must, in calculating the profit, be made from the market price, which at the time of my last visit was £10.* A great increase in the supply of foreign barilla, or the discovery of the long attempted problem to decompose sea salt by a cheap process, would destroy this most precarious source of profit; since the interests concerned in it are too few, and the total advantages too insignificant, to claim the protection of restrictive laws. In general, it may be remarked, that the kelp is reserved by the proprietor, and manufactured on his account; a very questionable piece of policy in some points of view. A large portion of the population is employed for the three summer months in the manufacture, which is so laborious and severe as to have no parallel in this country; certainly at least, not at the same rate of wages. This labour has been called compulsory, and in one sense it may be considered a servitude, since it is generally the condition of tenure and either the whole or a portion of the rent by which the tenant holds his farm. If he were a free labourer, it is often said, he would not engage in so disagreeable a task. But this, although abstractedly a painful view, is a false one, and is unjust as it regards the proprietors of estates; though casual visitors may be sometimes inclined to think that Highland proprietors have not yet forgotten their ancient habits of unrestricted sovereignty. It is a case of competition, and is the natural result of excess of population, combined with the absence of that proper and necessary division in an agricultural system which creates a class of independent labourers. The tenant must pay a fine for his farm, and he knows the price which he has to pay. That rent which he cannot procure by his surplus produce, he must pay by his labour, and as the system does not admit of a steady demand for work, he must labour when he can obtain it. An efficient and steady demand for labour might indeed affect the rate of wages, but it would scarcely leave the labourer the choice of refusing to work in the manufacture of kelp when called on. He might imagine himself free, his wages might possibly be greater, but still he must work wherever there is work for him. It is plain moreover in this case, that as the surplus produce of his farm does not enable him to pay the rent, and he must find the money for it by his labour, no advantage is gained if he is merely to repay the money with one hand which he has received in the other. He may in fact be considered as a cottar, subject to the calls of his employer, not so well situated perhaps, yet still as well as the state of the country admits. It is even to be doubted whether, in many cases, any thing short of this apparent compulsion could overcome the natural indolence and aversion to labour which, from whatever causes, is a strong feature in the character of the unimproved Highlander.

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* That price has occasionally varied even to £20, causing differences of serious amount in the value of these estates.

As far as relates to the details of this manufacture, they seem to have been for some years past in a state of rapid improvement, and to have attained on many of the estates, in consequence of the attention of the proprietors or their agents, all the perfection of which they are susceptible. The time occupied in it, as I before remarked, is about three months, namely June, July, and August. Drift weed, thrown on the shores by storms, and consisting chiefly of Fucus digitatus and saccharinus, is used to a certain extent when fresh and uninjured, but the greater part is procured by cutting other plants of this tribe at low water.* The differences in the declivity of the shores therefore, as well as in their linear extent, and the greater or less rise of the tide, together with more or less shelter from the prevalent surge, constitute the chief bases of the variations of a kelp estate. Soda is well known to abound most in the hardest Fuci, the serratus, digitatus, nodosus, and vesiculosus. On some estates they are cut biennially, on others once in three years, nor does it seem to be ascertained what are the relative advantages or disadvantages of these different practices. The weed is burnt in a coffer of stones, a construction which, however rude it may appear, seems fully adequate to the purpose.

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* The method of landing the weed after cutting is simple and ingenious. A rope of heath or birch twigs is laid at low-water beyond the portion cut, and the ends are brought up on the shore. At high water, the whole being afloat together, the rope is drawn at each end, and the included material is thus compelled at the retiring tide to settle on the line of high-water mark.

Attempts have been made to introduce kilns of a more refined construction, which have failed from the most obvious cause, the expense of fuel necessary for their support; the inventors appearing to have forgotten that the substance in the ordinary mode of treatment formed its own fuel. The number of these fires which during summer are for ever burning along the shores, give an interest and a life to these dreary scenes; recalling to the spectator's mind the activity of society in regions where all other traces of it are nearly invisible. The poet who indulges in visions of the days of old, may imagine the lighting of the war-fires, and fancy he sees the signals which communicated the news of a Danish descent through the warlike clans.

The quantity of sea weed required to make a ton of kelp is estimated, as I have already noticed, at 24 tons, but varies according to the state of its moisture, and hence a conception of the labour employed in this manufacture may be formed, since the whole must be cut, carried on horses, spread out, dried, and stacked, before it is ready for burning.

It is a subject of frequent dispute whether the estates would gain more by the conversion of this material into manure, than by the kelp manufacture, but it is a question of too complicated a nature to admit of a ready answer. If it be admitted, as I believe the fact is, that there is at present a sufficiency of this and other manure already at the disposal of the small cultivator, the question is fruitless. If it be supposed that the mere diversion of the whole sea weed to the land would bring a larger portion of that into cultivation, it will then be easy to put the question, and to enter upon the calculations necessary to answer it. But this is not a correct view of the case. A different distribution of capital, population, and employment is required before larger tracts of land can be effectually improved; and the diversion of the sea weed to this purpose is but a small part of that which is requisite to effect this object. When such alterations shall take place in the state of capital, population, tenures, and the division of lands, as will doubtless arise in the gradual course of improvement, it will be time enough to examine this question; and the solution will probably not be very difficult. In the mean time, while there is no such demand for it existing, and while the price of labour, however that labour be obtained, is such as to render it an object of profit to the landholder, it is futile to say that the making of kelp is not of advantage to the community. As a manufacture it furnishes employment to a half-employed population, and forms therefore a steady addition to its means. What remains of the argument respecting the relative claims of kelp and agriculture on the sea weed, must necessarily be a mere question of the market price of the former compared with the price of production.

But another doubt has been started, of a more refined nature and of far less easy solution. It has been asserted that from short sighted views respecting the profits of this manufacture, the proprietors have imagined they had an interest in a crowded population, by means of which the wages of labour were lowered, and a ready supply of it reserved for the purposes of making kelp. The consequences of such a policy, if it exists, would be to lower the rent of land as well as the price of labour, since a superfluous tenantry is here identical with an inadequate rent*. In this way, the landlord who is proprietor of the land as well as the kelp, would lose on one side what he might gain on the other. It is plain, that if the two properties were separate, the kelp maker would have a correct view, of his own interest at least, in wishing for a crowded population, which, as far as they are separated, he actually has. Whether the proprietor of both has or has not is a mere question of contingency. In him, the practice of crowding the population, admitting it to be a fact, is a mere commercial speculation in which he sacrifices a given sum in the shape of rent, for the contingent acquisition of another in the shape of profit on kelp. He cannot well be so blind as not to perceive that he is paying the price of labour in two distinct shapes, and it is clearly his interest to ascertain the price at which he is the manufacturer of the merchandize in which he deals. If his avarice or his ignorance are such as to render him a loser by his speculation, it is scarcely a subject for the interference of others: like other speculations it has a natural tendency to rectify itself if wrong, and must be left to that freedom which ought alone to direct all the movements of commerce. It will I believe be admitted by many of those who are acquainted with these islands, that there are tracts of land now occupied by small tenantry at an inadequate rent and under inefficient management, which if well managed would return a considerably greater profit to the landholder, and possibly exceed that which under the present system he makes by his kelp. But the changes required for this improved management of the land are such as cannot occur under the present state

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* As this proposition appears to contradict the common axiom respecting the effects of competition, it is proper to explain the cause. There is a point where, in this country, it ceases to have its usual effect and beyond which that effect becomes negative. From extreme subdivision arises bad cultivation, land imperfectly stocked, bad live stock, and consequent general poverty and inability. This result,

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if it were not every where apparent, would be proved by the increase of rent which has followed the consolidation of small farms, or, a diminution of competitors, such as these small competitors are. It is besides obvious, that the landholder who would increase his population for these ends, can only do it by offering his land on better terms than his neighbours.

of population, if we consider either its number or distribution. To produce these changes by violent measures is difficult, as various attempts have proved; were we even to leave out of consideration the painful moral effects which follow all those sudden and violent changes that operate on the state of population in a country. The changes have however commenced, and they cannot fail to spread. For the total benefit of the community, it is to be desired that they should, but it is also to be wished that they should take place with the least possible inconvenience and suffering to those who must, to some extent at least, be displaced. When the land shall have been raised to its adequate value, and to the state of improvement of which it is susceptible, a class of independent labourers will naturally arise to accompany the change; and the manufacture of kelp, which has perhaps already been dwelt on too long, will be subjected to a new calculation. But to proceed to the description of this island.

THREE distinct groups of hills occupy the western side of North Uist. The northernmost of these consists of a tame ridge bounding the sound of Harris, of which Ben Breach and Ben More form the chief eminences. The highest of these scarcely attains to 1000 feet. In the middle of the western division is found a second group, of which Croghan is the principal eminence, attaining to all appearance a height of 1500 feet, while the south western side terminates in a prolonged and irregular group of much lower elevation and of a smooth undulating surface, gradually declining into an uneven tract of good land. This forms the principal part of the arable land in North Uist, and is, in an agricultural view, the most profitable. The soil contains clay, a rare occurrence in this tract of country, and this by aid of the peat that in a greater or less degree predominates throughout the island, and with the addition of sand from the shores, forms an excellent mould. Much of the western shore consists of the same drifted sand which is so abundant in the islands to the south of this, and which, mixed with the peat in various proportions by its natural tendency to spread over the country, forms a light open soil applicable to the cultivation of barley and potatoes, particularly when manured, as is the practice of the country, with drift sea weed. The remainder of North Uist, comprehending the hilly region and the watery tract, is a mere mass of peat, producing little but the heath, rushes, and scanty grasses usual in similar soils, except in a few spots where by the assiduity of the small tenants or crofters, it is rendered capable of yielding an occasional crop of barley or potatoes.

The peat in this country is in general of considerable depth, reaching from ten to twenty feet downwards, and almost always incumbent on a body of alluvial gravel, or on the bare rock. In some situations it is found to repose on a bed of fine and soft, but not tenacious, pale greyish clay, which on burning is converted into a white powder, and applied by the natives to the purposes of scouring or polishing metallic utensils. It is a porcelain clay resulting from the decomposition of the felspar in the gneiss.

The peat of North Uist, as well as that of many other parts of the Long Island, is in a state of extreme decomposition at its lower parts. On this account it forms when dried a compact substance of great density, which is incapable of being again affected by exposure to rain, and which requires therefore no protection when completed. Its specific gravity is much greater than that of ordinary peat. It burns with so bright a flame as to supersede the necessity of light in the cottages of the natives, and with a glow of heat equal to that of the inferior kinds of coal, while it is capable of being formed into a compact charcoal fit for the purposes of the blacksmith. The introduction of a few remarks on the formation of this substance will hardly be deemed to require excuse, as it is a question intimately connected with geology.

THE subject has indeed been so frequently examined that but little remains to be said on it: had less been written it would not perhaps have so often been involved in unnecessary obscurity.

Agriculturists have distinguished it into several varieties, partly determined by its situation, and partly by corresponding changes of texture. It is not necessary to follow them further than merely to remark, that according to the nature of the substratum, the drainage or lodgement of water to which it has been exposed during its formation, and the plants which enter into its composition, it presents differences of aspect, with some slight variations in its chemical qualities; the latter corresponding to the extent of change the constituent vegetables have undergone.

In general it forms but a single stratum bedded on the rock, or on the alluvial matter above. Occasionally however it is found alternating with sand, clay, gravel, or shell marle. The latter alternation is the most remarkable, and occurs only when the peat has been formed under water, or when, after the drainage or extirmination of a lake, it has grown above the decomposed mass of fresh water shells which occurs in those places. The former alternations occur either from the blowing of sand on the sea shores, or from deposits of alluvial matter brought down by mountain torrents.

Although fragments of trees are frequently found buried in it, these are not essential. They must be considered as accidental substances, and occur in those cases where it has been formed in forests, partly from the decomposition of their fallen leaves, partly from that of the plants which grew under their shade. Oak, fir, alder, and birch, are the woods most frequently found, and it is almost unnecessary to say, that the remains of animals and other accidental substances are occasionally buried in peat. The plants which by their destruction contribute to its generation, vary according to the situation in which it has been formed. In any one situation some species are more abundant than others, from circumstances too obvious to need enumeration. It has often been asserted that Sphagnum palustre is the true basis of peat; this however is an unsupported opinion. Doubtless, in peculiar boggy situations it forms a predominant ingredient, but large tracts of peat may be found in many places where this moss never grew.*

The process by which these vegetables are converted into peat is very obvious, and the consequent increase of that substance is easily understood, without endowing it, as has been often done, with living powers. It is most easily seen in the Sphagnum. In this, as the lower extremity of the plant dies and is decomposed, the upper sends forth fresh roots, like most of the mosses; the individual thus becoming in a manner immortal and supplying a perpetual fund of decomposing vegetable matter. A similar process, although less distinct, takes place in many of the rushes and grasses; the ancient roots dying together with the outer leaves, while an annual renovation of both perpetuates the existence of the plant. Other vegetables again add to the common stock by their annual death, their existence being repeated in seedling plants; while others still, of a perennial nature, contribute only by the ordinary decay and renewal of their leaves and flowers.

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* The following list contains the plants that most frequently concur to the generation of this substance, and they are placed with some regard to their importance:—

Sphagnum palustre.
Scirpus cœspitosus.
Nardus stricta.
Scirpus palustris.
Juncus conglomeratus.
——— effusus.
Eriophorum polystachion.
——— vaginatum.
Schœnus nigricans.
——— albus.
Erica tetralix.
—— cinerea.
—— vulgaris.
Myrica gale.
Juncus bufonius.
——— bulbosus.
Agrostis canina.
Aira cœspitosa.
Pedicularis palustris.
Orchis maculata.
Carex dioica.
—— pulicaris.
—— flava.
—— panicea.
—— cœspitosa, and others of this genus.
Anagallis tenella.
Menyanthes trifoliata.
Comarum palustre.
Empetrum nigrum.
Ranunculus flammula.
Scirpus acicularis.
Nymphœa alba.
——— lutea.
Potomogeton natans.
Drosera rotundifolia.
Juncus squarrosus, besides others, many of them of such rare occurrence as not to deserve enumeration.

The progress of this decay, the gradation from the living vegetable to solid inorganic peat, is generally easy to trace. Where the living plant is still in contact with it, the roots of the rushes and ligneous vegetables are found vacillating between life and death in a spongy half decomposed mass. Lower down, the pulverized carbonaceous matter is seen mixed with similar fibres still resisting decomposition. These gradually disappear, and at length a finely powdered substance alone is found, the process being completed by the total destruction of all the organized bodies. If this process has been carried on upon a drained declivity, the result is a loose powdery matter, namely, heath soil, or mountain peat; if in an inundated or wet soil, it is a mixture of that powder in the water, or the flow moss of agriculturists. Intermediate circumstances produce intermediate conditions, and thus many varieties of peat are the result; while all these are further increased by differences in the vegetable ingredients, in the time during which the process has lasted, in the degree of drainage, and in the elevation or other causes affecting the temperature or moisture of the atmosphere. The properties of peat as a fuel vary according to those circumstances; the best being that of which the decomposition is most complete and the specific gravity and compactness greatest. Such is the case in that of North Uist which has given rise to these remarks.

As the growth of peat necessarily keeps pace with that of the vegetables from which it is formed, it is evident that the cessation of the one is implied in that of the other. Hence the necessity, now at length understood, of replacing the living turf on the bog whence peat has been cut; a condition now required in all leases where liberty to cut it is included. No vegetable seems willingly to attach itself to pure peat; and thus a bog once bared to a sufficient depth remains naked: where the decomposition is but incipient, the process of vegetation is renewed and continued without difficulty.

The solubility of peat in water varies according to the degree of vegetable decomposition: pure peat communicates no stain, and the brown water that contaminates the rivers of the Highlands is derived from it in the incipient stage of the process. The cause of this will appear from considering the nature and progress of the chemical changes; on which I shall bestow but a few words as they are abundantly simple; although, like the rest of the history of this substance, much misunderstood.

If recent vegetable matter be distilled carefully by a red heat, it is converted into charcoal, acetic acid, and an oil varying in density according to the stage of the process, together with an occasional small quantity of ammonia. No inflammable gas is produced but by mismanagement of the operation. It is unnecessary to describe these results more particularly, as I have treated of them at some length in the 2d Vol. of the Geological Transactions. There is in this case a certain proportion between the coal and the oil. This latter substance, under its various modifications of pitch, tar, or essential oil, is compounded principally of hydrogen and carbon. Now if peat be subjected to the same process we obtain the same results but in different proportions. The acetic acid is diminished and the oil bears a smaller proportion to the charcoal, that proportion diminishing gradually according to the perfection of the peat. Consequently the chief effect of increasing decomposition in the peat is to diminish the proportion of the hydrogen to the carbon in the vegetable compound, of which these are the principal constituents. The effect of water on the vegetable fibre is therefore similar to that of fire, although less perfect; since, after the last efforts of the former substance, a considerable portion of hydrogen remains combined with the carbon; even in the lignites, of which the changes are more complete than those of any peat with which we are acquainted. In the incipient stage of the action of fire, the compound of carbon and hydrogen is partially soluble in water, a familiar example of which occurs in the roasting of coffee, and the same takes place in the conversion of vegetables into peat. In each case when the proportions of these two constituents have attained a certain ratio the compound is no longer soluble.

The simple principles thus laid down seem to contain every thing requisite to explain the chemical nature of this substance, and I shall not therefore pursue them further. They will serve to unravel and reconcile many obscure and contradictory experiments, and in pointing out the causes of the varieties of peat, assist agriculturists in their pursuits by directing their attention to the essential differences.*

I have had occasion to observe in the island now under review, as well as in South Uist, that peat is sometimes luminous, a phenomenon analogous to that produced by wood in a certain stage of decomposition. This fact is, I believe, also noticed by some oriental traveller.

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* It must be obvious, that the conversion of peat into soil will be difficult in proportion to its perfection; since independently of its greater compactness, it approaches more nearly to the state of charcoal, bearing, to imperfect peat, an analogy resembling that which effete does to recent manure. Hence also a hint may be derived respecting the conduct of that process by which the manure called the Meadowbank compost is formed.

There appears to be great variety in the time which a given mass of this substance requires to accumulate; as might indeed be conjectured from the various energy of vegetation in different situations. Two or three registers of time are to be found in this country, in the dates of substances lying beneath it, but they can only be considered applicable to the particular places where they exist.

A Roman road is found on the clay under Moss Flanders in Stirlingshire, a raft of squared timber having also been discovered in the same place. The peat here varies from twenty to forty feet in depth. A road formed of logs of wood was also found under Kincardine moss, together with felled trees laying on the clay substratum, these being probably of the same date with the former. In more recent times Camden has described the park which now lies under Chat moss near Liverpool, and the palings have been recently found in digging into that spot. But it is not my design to enter further into this subject.

Yet it will not be out of place, after this very slight sketch of the nature of peat, to bestow a few words on its economical details as applied to the purpose of fuel, of which it forms the sole article in these islands. The consumption is unavoidably great, since, independently of the constant demand for cookery, the moisture of the climate renders fire almost as necessary in summer as in winter. Although the total supply may be considered, in a general sense, inexhaustible, some of the islands labour under serious inconveniences from the want of it. Tirey, Canna, Iona, and Muck, are in this predicament; which adds considerably to the expense of the tenant, and consequently detracts from the value of the land. A commercial arrangement which should supply these islands with coal from the western parts of Scotland, would tend much to their improvement; but it is at present, under the existing division of farms and the consequent want of a constant and regular basis of exchange, impracticable. It is indeed a case parallel to those which must always happen in countries similarly divided, similarly peopled, and where there is no steady demand for labour; where consequently no occupations exist by which an exchangeable commodity can be generated. If it is true that the price of peat in Tirey is five times that of coal, when the charges of procuring it are considered, it is equally to be remembered that the labour now employed on that object has at present no other adequate vent; and that its value must be estimated, not as it is thus employed, but as it would be employed if it were not directed to that tedious and laborious occupation. The price of peat may thus in certain extreme cases be perhaps nothing. The same argument applies to a proposal which has been made, to establish in the Long Island, where the peat excels both in quality and quantity, a manufacture for the purposes of a general supply, and to reduce it to a distinct occupation. Could such a manufacture be established, it is plain that the consumer must find something to give in exchange, and it is not difficult to see that the inferior price and superior quality of coal, conjoined to the activity of an established commerce, which is always ready to create a new market wherever there is an opening, would soon drive the peat competitors out of that market. Like most other established systems, that of the Islands, if it be bad, is at least consistent; and, like those, its bearings are so numerous, that he who attempts to repair a part without a regard to the connexions which it has with the whole, will act like a legislator who should attempt to reform New Zealand by introducing the Statutes at large. It is not that improvements cannot be compulsory: the fault is, that the improver takes too narrow a view of the bearings of the evil, and of those of its remedy: while he is damming the stream at one aperture, it escapes him at another; such is the slippery nature of political economy.

The labour of making peat is in truth an evil which it would be most desirable to see remedied; since it occupies a great portion of the summer, employs many hands in the making, and many animals in the carriage; while even all the labour which can be commanded is sometimes insufficient to procure an adequate supply. It is estimated at a third of the total expense of the farm; an estimate probably in some cases not beyond the truth. In this island however, and generally through the Long Island, the vicinity of the peat, together with its compact quality and goodness, renders it a much cheaper article.

HAVING mentioned alluvial gravel as being found under the peat in North Uist, I may proceed to remark that considerable alluvia are to be observed on the surface in various parts of this island; considerable at least, when compared with their almost total absence in the southern islands of the range. These are independent of any present flow of water, and are found either occupying the declivities of the hills, or forming small elevations over different parts of the surface. They are accompanied by an occasional decomposed state of the rock, an occurrence, as we have seen, scarcely to be remarked in the southern islands, and one, from which have undoubtedly arisen the deposits of clay and soil already mentioned. This indeed is not the only circumstance that marks in North Uist the action of causes which the southern islands appear to have escaped. A group of small islands lies in the entrance of Loch Maddy, the nearest of them being a mile from any shore, and the sea which separates them varying from seven to fifteen fathoms in depth. Yet on the surface of some of these is accumulated a thick bed of alluvial clay and rubbish; sufficient to mark their former connexion with some higher tract of land, and to serve as a record of those changes which have hollowed the sinuosities of that loch. I need not enter on the probable causes of these changes, as they have been often discussed, and as in describing the island of Staffa, which exhibits a remarkable example of this nature, every thing is said which occurs on the subject. I may only remark, that the alluvial matter and the rolled stones which are seen in these islands, are all equally the produce of the islands themselves, no boulders of granite, except fragments of the granite veins, being any where found among the substances scattered over their surfaces.

Having repeatedly mentioned the accumulations of sand which occur on the western side of this tract of insular land, and which are as prevalent in North Uist as in the islands that lie to the south, it appears necessary to describe more particularly their nature and progress, as far as it is possible to decipher that progress, often very obscure. This is a phenomenon with which geology as well as agriculture is concerned, since these accumulations, which tend at times to fertilize and at others to overwhelm and destroy the soil, may also lay the foundations of beds capable by future changes of being converted into strata of marle, or, ultimately, even into limestone.

The sand thus accumulated on the western shores of this land, is formed for the most part of various comminuted shells, of which however only fragments can be obtained; insufficient to show the species from which they have originated. Such shells in their living state form beds, as the sounding line testifies, skirting the eastern shore; fine shell sand as well as clay being also found at different depths along the coast. In some places, as in Barra and Vaterssa, this sand seems to consist of shells only, while in North Uist as well as in other parts, a portion of quartz and hornblende, the result of the wearing of the rocks, is mixed with the calcareous matter.

It is not easy to perceive the exact mode in which the sand proceeds, nor the precise changes which take place in consequence of its movements; changes which, according to some reporters, consist in a loss, according to others in an acquisition of land. It will probably be seen, that both are occasionally in the right, the loss of one party being often the gain of another. When the actual appearances have been described, some judgment of this question may perhaps be formed.

The flat sandy shore which the tide alternately covers and deserts, is succeeded by a tract of loose blowing sand, interspersed with hillocks and broken banks of the same materials, slightly compacted by the roots of the Triticum junceum, Carex arenaria, Galium verum, Anthyllis vulneraria and other well known tenants of similar soils. Beyond this, in the interior, the sand is irregularly diffused over the surface, according as the forms of the ground admit of the free progress of the wind, or oppose obstacles to its motion. Continuing to spread, it becomes more and more intermingled with the peat or other natural soil, forming mixtures of different degrees of fertility. Wherever a sandy bed is perforated, a foundation of peat appears. If now we examine the sand hills which form the second zone here described, we shall find them more or less perfect. In many cases they have nearly disappeared, leaving only pillars or fragments remaining to prove their former altitude, which often reaches to twelve or fifteen feet and even more. The mode in which the sand hills waste is apparent. If a hole be made, or a turf removed from the surface, the wind gradually enters it, scooping out the loose sand, until, in the progress of years, the whole is mouldered away and transferred to a more distant point from the sea, where it is diffused over a wider surface. Thus in North Uist, as well as in other places, we trace the ruins of elevated banks now nearly reduced to the level of the shore; and here the spectator, like the tenant of the farm, is ready to imagine that the sea encroaches on the land. In another place, a tail of sand may be seen accumulating under the lee of a rock, or of a former bank, or of some other protecting obstacle which, by checking and retaining the land water, and thus giving root to plants of a dense growth, or by encouraging the growth of the common sand plants, gradually causes it to increase all around, repelling the sea and forming a new bank, the foundation of future fields. Here the land gains on the sea. It is probable that the gain and loss are throughout this line of coast pretty equally balanced; perhaps we should rather conclude that the advantage is in favour of the land; since every sand hill removed by the winds was first brought from the sea, and there is no reason to think that the production of shell sand is diminished, or the power of the winds and waves in transferring it to the land abated. An admirable register both of the increase and diminution as now stated, may be seen in an ancient chapel situated at the north-west angle of this island, of a date, like the other antiquities of this country, unrecorded in history or tradition, and without architectural decorations from which to conjecture its æra. It has been erected at a time when the sand was at a level pretty nearly intermediate between the present lowest one and the highest, as that is marked by the remaining surfaces of the sand banks. This level is also indicated by the proportion of the walls. At a subsequent period it has been overwhelmed with sand, of which the record is also marked by numerous banks of a high level, one of which, to the leeward of the gable, still overtops it, tailing away under its protection at a height similar to that of the neighbouring banks. But the process of destruction long since commenced at the windward side, has again denuded it even below the foundation in that quarter, the final removal of the bank being only impeded by the coffins, of which the exposed surfaces are seen covering the ground, while their contents are whitening in the wind and spray.

Such are the appearances of the coasts, and such the nature of the revolutions which seem to have taken place on this shore. These changes appear, in an agricultural view, to counterpoise each other. By the progress of the sand into the interior, new surfaces of peat are rendered productive, and the arable extent of territory is on the whole increased. It is true that the advantages may be transferred from one set of tenants to another, since that sand which in its diffused progress fertilizes the more distant soil, may by its abundance suffocate the intermediate land over which it passes. The proprietor however gains, since the extent of reclaimed land will prove much more considerable than that of the injured, when we reflect that the predominance of water in the interior soil, renders useful that sand which, in the flatter and arid shores, is condemned to almost hopeless sterility. I have been thus particular in attempting to elucidate this matter, because it is a phenomenon of common occurrence, the right understanding of which may often be of considerable importance in agriculture. It is important also to show that the transference of sand, although in some cases destructive, is in others attended with advantage, particularly when, as in this instance, it consists of fragments of shells. It is also necessary in a geological view to attend to all those changes by which the state of the surface is altered; of which changes none have been liable to more misapprehension than those which occur on sea shores.

I have suggested the possibility of such accumulations of sand being ultimately convertible into marle, or even into limestone. There is in fact no apparent reason why the consolidation of such materials should not take place under the soil as in the sea. No appearances, I believe, have as yet occurred to geologists which either require, or would admit of such an explanation; but such cases may be imagined, and it is in the mean time useful to register all those facts which may ultimately tend, even by the remotest probabilities, to elucidate this obscure science.*

In the account of South Uist and Barra, the want of springs and water courses has been noticed, and it was remarked that the lakes appear to be filled from the drainage water of the surface. The same remark, though in a somewhat less degree, is applicable to North Uist; since its more numerous elevations give rise to a few small streams, which although not permanent, are more frequently filled than those of the southern islands. The vicinity of the mountainous land of Harris appears also to generate more rain in North Uist than is observed to fall in the southern division of the chain.

In this island, as in many of the others, are found remains of military works now nearly obliterated. These, according to the predominant custom of the people every where, are called Danish. The most remarkable are situated on small islands in lakes, but they present little but heaps of ruins. One of them which I examined, was connected by a raised causeway with the shore. It has been supposed by some antiquaries that the works situated in islands were actually Danish or Scandinavian, and that they were thus distinguishable from the similar fortresses of the British, which were supposed to be always placed on hills. But it is fruitless to discuss these questions, since not a shadow of evidence can be adduced respecting them. It has been on all occasions found that there was a considerable resemblance in the manners, usages, warlike weapons, and monumental practices, of the original British or Celtic inhabitants and those of their early invaders; and there seems no ground for attempting a distinction in the structures which they erected for the purposes of defence. Such a systematic distinction at least as that above mentioned is little likely to have existed in rude nations whose immediate necessities were the spur to these undertakings: systems are the offspring of refinement.

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* I have formerly noticed the gay appearance of the sandy plains which are prevalent in these islands, and occasionally mentioned the most conspicuous of the plants which inhabit the pastures, of which the fragrance perfumes the air around. I shall here enumerate all the plants which I observed in a single green plain, a list which will, I believe, apply to the whole of this tract of country, as well as to the sandy shores of the other islands. Holcus lanatus, Bromus mollis, Festuca duriuscula, Agrostis littoralis, Festuca ovina, Aira flexuosa, Aira præcox, Lolium perenne, Vicia cracca, Potentilla anserina, Geranium sanguineum, Trifolium repens, Thalictrum pratense, Bellis perennis, Ranunculus arvensis, Plantago lanceolata, Anthyllis vulneraria, Galium verum.

Numerous barrows are also found in this island, and a group of them is still remaining in one of the sandy tracts of the north western shore, though many have doubtless been either overwhelmed or blown away, in consequence of the continual transference of the loose sand. Similar barrows are known to abound throughout Scotland as well as in South Britain, although the cairn of stones is, in the former division of the island, more prevalent than the tumulus of earth. Such memorials, on being opened, have generally been found to enclose urns, sometimes further secured in stone chests and containing ashes, as well as trinkets, weapons of war, and other objects of affection or fashion; the burning of the dead appearing to have been a prevalent custom during the ages which preceded the introduction of Christianity. At times entire skeletons have also been discovered in them. Recently, one of the barrows in North Uist was opened during the operations of levelling and clearing some rough ground, and was found to enclose a skeleton in an erect posture. As we have no records of such a practice as the interment of bodies in an erect position, it is probable that this was one of the hiding places which, till lately, are known to have existed in several of the islands. These subterranean apartments were used as places of retreat in cases of sudden invasion, and seem to have varied in construction. Sometimes they were built of stones, being of commodious forms and of considerable capacity: in other cases a cavity in the shape of a well, lined with stone, and adapted to the size of the body has been discovered: while the rudest, to which the one in question seems to have appertained, were mere pits dug in the earth, and covered with turf for the purposes of temporary concealment. The unfortunate Celt above recorded, seems to have perished in his retreat during the heroic times of this envied age.*

THE reader who has followed these details through the islands already described, will doubtless still expect to find gneiss forming the sole rock of North Uist. Although this in a general sense is true, there is fortunately here some variety in the ridge of Heval, already mentioned as forming the eastern hilly margin of the island. Such variations give a necessary stimulus to the observer, whose ardour is apt to flag in searching for novelty which he is doomed not to find; and they re-excite his languid endeavours to watch with renewed attention for changes which, though at the moment concealed from him, may possibly be on the brink of rewarding his labours. The ridge of Heval is an Oasis in the desert of gneiss, and independently of this merit, it possesses that interest arising from obscurity which never fails to rouse the attention.

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* A perfect example of these subterranean retreats is found near Tongue in Sutherland. The external entrance is formed of large stones arranged in the same inclined manner as in the Pyramid of Cheops. This seems to have been the origin of the arch, a subject respecting which much has been written. Between this and the pointed Gothic arch the transition is indeed but small, the curvature of the two inclined stones forming the first stage of it. Some of the earliest structures of Greece present examples both of this modification and of that immediately subsequent, where a third stone fills the interval left at the apex. But I cannot here enter on a subject which is the province of architectural antiquaries. It would require an essay to contain the evidence in favour of this view which might be derived from ancient architecture both European and Oriental; and which appears to prove that the circular has been derived immediately from the pointed, or Gothic arch. It is obvious that the confusion of styles in the ancient architecture of England does not interfere with this argument, as it may be explained by supposing that the ecclesiastical builders drew from two distinct sources, the Roman and the Oriental; an opinion supported by many collateral proofs. The pointed arch is of a much prior date to these buildings.

The Sketch, Pl. 30. fig. 3, will serve to convey a general notion of the transitions in question.

The aspect of the surface of this ridge and the character of its outline are so precisely similar to that of the island in general, that an observer, contented with a superficial view, would without hesitation note it as formed of the same rock. It offers a strong example of the necessity which the geologist is under of taking nothing on trust, and of concluding nothing from induction when the evidence of contact can be obtained. The account of the ridge of Heval will be rendered more intelligible by disturbing the geographical order of this description; and the reader will thus gain a key to solve difficulties which were to me a source of much research and trouble.

It was shown that North Uist is separated at its southern extremity from Benbecula by a complicated strait; improperly called Loch Rueval, since it has a free communication with the sea at both ends. This passage is strewed with a multitude of islands, Grimsa, one of the principal, having already been mentioned under the head of Benbecula, on account of its geographic resemblance, as well as its physical identity. Many more, which I have thought it unnecessary to notice, such as Flodda, Bent, Broad Isle, and others whose names are scarcely known, belong like Grimsa to this division; consisting of gneiss, and resembling their parent Benbecula in every particular. But the hilly island Rona, together with its dependencies, Flota beg, Flota more, and others of minor note, are distinguished from these, as much by their external aspect as by their structure, and ought to be ranked as portions of North Uist. There is also a chain of small islands lying off the mouth of Kyleswia, which, although more apparently connected with Benbecula, appertain in geological character to the islands in Rueval, now to be described. As I did not examine all the small islands scattered along this shore, some, which I have judged to belong to the gneiss of Benbecula, may perhaps prove, like Rona, to be parts of the rock of Heval: but these omissions are of no importance.

Close to the two Flotas is a small island, not named in maps, which is here selected on account of its simplicity, as a foundation for the description of these obscure rocks. It consists of an argillaceous schistus of a pale grey colour, placed in beds nearly horizontal or with a small elevation, and apparently with very little disturbance. Some of the small rocks and islands in the neighbourhood exhibit a similar construction with slight variations. The schist is sometimes of a dark lead blue, of a more compact texture, and less regular in position; and in many places it contains green, compact felspar diffused through it in threads and laminæ. In some other places it assumes a diversity of character; and among these, Flota beg and Flota more offer the largest surfaces for examination. The schist is in these islands occasionally traversed by granite veins, similar in aspect and composition to those which traverse the gneiss of the neighbouring parts. This may be adduced as a proof of the posteriority of these veins to the rocks which they intersect; since they are here, as in Coll, found to pass indiscriminately through two different rocks, of which the one appears from its position to be of more recent formation than the other. It was already remarked in describing Iona, that where the argillaceous schist approaches to the mass of granite it acquires a new character, being interspersed with grains of felspar and quartz, or passing into a rock intermediate between granite and schist, or ultimately acquiring the external appearance of a gneiss of which the laminar tendency is produced by foliated portions of the schist. Something similar occurs in the schist in this place. Where it approaches the granite veins it is much disturbed in its position, and the laminæ become twisted and bent, or disappear altogether. Often, it is found to contain grains of granitic matter distinctly interspersed; which accumulating in some places, there is at length seen a perfect transition from schist to granite. In examining the contact of these distinct bodies, many varieties produced by this transition can be seen disposed in every mode of confusion. The surfaces which have been exposed to the action of the sea often show the marks of this mixture of character where it is not so easily detected by a fracture. They are every where thickly strewed with prominent points, the crystals of a harder matter which has resisted corrosion. This rough schist is mixed with the smooth, but in no evenness of order or regularity of alternation, the two kinds, as well as the accompanying granite veins, being every where confounded together in an irregular manner. There can be no hesitation in considering the rough schist as a portion of the smooth, altered by the contiguity or influence of the granite veins. The phenomena here are perfectly similar to those which occur both in the schist and limestone found in the vicinity of the granite in Glen Tilt; of which I have given an account in the Transactions of the Geological Society.

The same varieties of schist may also be observed at the foot of Heval, and on the shores of Rona. They constitute a rock distinct from gneiss, and will probably be considered as of more recent formation. It has indeed been said that clay slate, to which the schist in question belongs, is removed from gneiss as well as from granite by the intervention of micaceous schist, and that it is the third rock in order from granite. It has been shown that in Iona, clay slate is in contact with granite, and it will here be seen that it is in contact with gneiss, nay probably, in a state of alternation with that rock.

If we follow the eastern shore of North Uist. we find the same argillaceous schist occupying the whole line, with trifling exceptions, wherever at least that shore is accessible; and forming the lowest skirt of the range of hills here denominated the ridge of Heval. As may be expected, it varies considerably in different places, but after what has been already said in describing the small islands in Rueval, it is unnecessary to dwell on these variations. In many parts of this line, gneiss as well as schist is seen; the two rocks occurring in an irregular manner, and mixed in such a way as to give the greatest reason for supposing that they alternate. But if alternation can only be admitted where beds of one substance are found distinctly interchanged with those of another, it cannot be proved to exist here, on account of the extreme confusion which attends these rocks. Though the schist and gneiss occur alternately, neither of them is straight even for a small space, so that the relations which the one bears to the other cannot be determined. It is not in the least uncommon to find vertical beds in one place, and not an hundred yards from them others equally regular and absolutely horizontal.

The next rock that occurs in Heval has an external form and aspect precisely similar to that of the gneiss which it accompanies, being rounded and difficult of decomposition, and causing the hills to appear as if paved with rocks, to the almost total exclusion of vegetation. The beds, like those of the gneiss, are irregularly placed, occupying every possible direction, and being much contorted and dislocated. It alternates, or is mixed in the irregular manner already described, both with the schist and with the gneiss by which it is accompanied. It is to be found in some of the low islands at the mouth of Kyleswiaveg, but is most conspicuous and most easily examined in the hills themselves, appearing to terminate in gneiss on the shores of Loch Maddy, as it ends in mere schist on the sea shore. It is difficult to render intelligible by description, the aspect of a rock or mixed mineral, but this will be most easily understood by referring the several varieties to those better known rocks which, in its simplest state, it most resembles. At one extreme it appears to be a lead coloured compact felspar, characterized by extreme toughness, and often by a twisted texture; displaying at the same time a mixture of lighter and darker tints. When straight and even in the fracture, it resembles on a superficial view a siliceous schist. Occasionally it is interspersed with grains of transparent quartz, in which case small fragments would readily pass for specimens of hard felspar porphyry. At times it is so penetrated by quartz diffused throughout in a sort of regular gradation, that the boundaries of the two are not visible. A new set of varieties is formed by similar admixtures of common felspar; while other specimens present mixtures of felspar and quartz, or felspar and hornblende, or hornblende and quartz, or of all the three substances united with the base. It passes in these cases into granite, or into hornblende schist; or, by the ultimate exclusion of argillaceous schist, into gneiss. Portions also of common compact pale felspar are found in it, or beds in which this rock forms a basis slightly modified by the occasional mixture of other ingredients. Such are the characters of the different portions of this rock, for which no name has yet been assigned, and of which I have no where else met with any resemblance. It may perhaps be considered as intermediate between gneiss and compact felspar; but the venous distribution so generally to be traced in the latter substance rather seems to point it out as a gneiss altered by the subsequent intrusion of this mineral, and thus analogous to the rock described in Barra.*

The gneiss found on the shores of Loch Maddy, occurs in all the variety of form and composition so often described, and may be traced throughout the greater part of the island. If there is any difference, it consists in the proportion of the straight being greater here to the contorted and displaced rock than in the preceding islands. In some few places I observed beds so thin as to be capable of splitting into leaves not ill suited for heavy tiling, and, in others, it seems to pass, as in similar situations, into an unfoliated syenitic granite.

The ramified basaltic veins formerly described as so abundant in Barra, are more rare in North Uist; but they also occur, being found in one or two places traversing the anomalous rock of Heval, and adding materially to the already complicated nature and obscure appearance of that rock.

The other trap rocks that occur in this island have an unusual claim on a separate notice, as they present features of rather more importance than in those already described.

The entrance to Loch Maddy, (the Lake of Dogs) is marked to mariners by two remarkable detached rocks situated about a quarter of a mile from the shore, named Maddy more and Maddy grisioch. The former is about 100 feet in height, and presents towards the land, a face irregularly columnar and inclined to the perpendicular in an angle of about 20°. The latter is much less distinctly marked by the tendency to vertical division, is nearly of the same altitude, but appears about twice as large, its abrupt face looking equally towards the land, while, like the former, the opposed side shelves to the sea in an angle equal to the vertical deviation. Both these rocks are composed of a dark blueish grey and compact basalt, and they are remarkable as being the only rocks of this nature which occur on this coast, or in any part of the chain of the Long Island.

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* I have since found a similar rock occupying a large tract on the north western coast of Ross-shire and passing into gneiss of the more ordinary characters. It may therefore be safely ranked among the varieties of that rock. 1818.

There are many large veins of trap to be seen on various parts of the eastern shore of North Uist, but two of the most remarkable lie exactly opposite, one to each of, the rocks now described. The vein opposite to the Maddy more is easily seen in a lateral section, in consequence of the fall of the cliff, and offers some interesting appearances. Viewed in front, its section appears parallel to the beds of clay slate which it traverses, but when seen from a lateral position it is found to cross them in a curved and somewhat waving course, terminating at the surface nearly at right angles to its original direction, and to the general bearing of the schistose strata. It is about twenty feet thick, and is divided by parallel lines into two or three beds; of which one, about three feet in thickness, is amygdaloidal, containing nodules of mesotype and of analcime. The others have a tendency to split into irregular columnar forms. The phenomenon of stratified trap veins is not uncommon, but this and the accompanying instance are the most perfect examples of this structure that I have met with, since it is accompanied by marked differences in the several strata. This latter example, lying opposite to Maddy grisioch, is nearly straight, and has at first the appearance of a bed, but it is easy to perceive that it has no continuous conformity of position with the schist which it accompanies. In both cases the schist is much confused and distorted.

What connexion may exist between the detached rocks and these veins, either here, or in Barra and the neighbouring islands where they have already been described, does not appear. It is not absolutely necessary to imagine masses of trap in the vicinity of every vein; yet it is not improbable, that, as these are always found predominant in the neighbourhood of such masses, the veins which occur throughout this part of the Long Island originate in masses of trap connected perhaps at some distant period with that of Sky, and of which Maddy more and Maddy grisioch are the only visible portions remaining.

It would be superfluous to describe all the trap veins that occur along the east shore of North Uist. One however of a remarkable structure is to be seen in the little island of Hamersa in Loch Maddy. It is about fifteen or twenty feet in thickness, passing through the gneiss in a position nearly vertical. It is irregular, being split into minute ramifications and thus very much confounded and mixed with the including rock, which is of an uncommon hardness. The weathered surface of this trap vein is studded with the same granite points as the schist of Flota More and Flota Beg. It possesses a degree of toughness scarcely inferior to that of cast iron. When broken it displays a number of minute red spots of a granitic aspect, but bears no resemblance to any of those well known greenstones in which red felspar forms an ingredient. In what respect this hardness and structure depend on the gneiss with which it is so intimately mixed, we can only conjecture.

Among the mineral substances commonly found in gneiss, North Uist, like the neighbouring islands, abounds in reddish, grey, and white felspar, forming concretions in the granite veins often of very great magnitude. In some of the small islands situated in the entrance of Loch Maddy, it is found of a fawn colour. In one of these, Rilee, there is a considerable bed of opalescent quartz, very much resembling that which occurs in Coll, but more pure. This is occasionally tinged with a slight pink and with a blueish colour, but the greater part of it is milky. In many places the quartz which belongs to the gneiss is grey and semi-transparent: in others it is very dark, approaching to greyish black. In the same place crystals of hornblende of three or four inches in length are seen imbedded in quartz, and hornblende rock is also found in large concretions in the gneiss on the shores of some of these islands. These latter are often of a singular appearance, being formed of a congeries of crystals, loosely attached and, like coccolite, falling into grains by a very slight force. In certain situations garnets also occur in the gneiss beds.

Of minerals unconnected with gneiss I observed none but a species of bog iron ore accompanied by pyrites. This is used by the natives in dyeing, with the assistance of tormentil, galium, lichens, and other native plants; the uses and properties of which are familiar to the Highlanders every where, as they are to the Tartars who inhabit the plains of the Don.

RONA* (WEST.)

It has been already remarked that this island was a physical portion of the ridge of Heval, but it possesses some peculiarities worthy of attention. It is about 600 feet in height, presenting in its higher parts the same rocky aspect as Heval, and some low productive land being found skirting the shore. It is much indented, and exhibits to the east a broken face which seems, like the rest of the eastern shore already described, to consist of schist much disturbed and traversed by trap veins.

The same irregular mixture of gneiss, schist, and the anomalous rock described above, are found forming its upper parts; both the mixture of the several rocks and the gradation from the schist to the gneiss being perhaps even more distinctly to be traced here than in the ridge of Heval. Where there are opportunities of observing this gradation, the change seems to be performed by a gradual increase of the granitic ingredient, the schistose parts communicating the laminar tendency. There is thus produced a rock with a perfect resemblance to gneiss, those portions which in more ordinary cases are formed of mica or hornblende, consisting of argillaceous schist. Reticulated trap veins are even more numerous here than in Heval, and they add much to the extraordinary appearance of this already obscure rock. Fawn coloured as well as dark quartz is found in the gneiss, together with felspar under the usual aspect which it possesses in these islands, being splendent and nacreous. Besides these, distinct beds of the same compact felspar described in Iona occur in different places, some of them being penetrated by basaltic veins so as to form a very singular compound rock. One of the beds of gneiss is remarkable on account of its beauty, consisting of a fine grained snowy and equable mixture of quartz and felspar in which the several ingredients are scarcely distinguishable.

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* Rona. Ron, a seal, Gaelic: Seal Island: a common appellation among the Western Isles.

The most conspicuous of the trap veins on this coast occurs at the southern end of Rona. It is nearly vertical, being thirty-six feet thick and traversing the schist in a N. N. W. direction. It is rendered interesting by the nests of tufaceous amygdaloid which are irregularly dispersed thoughout it and contain nodules of radiated mesotype.

A great number of islands, some of considerable magnitude are found skirting the northern and western shores of North Uist, and dispersed throughout the sound of Harris.* They seem so unquestionably to be scattered portions of that island, or the fragments of a common mass, that I thought it unnecessary to examine them all, and now think it useless to describe those which I did examine, since they afford room for no remarks in addition to those which have been repeated, perhaps unavoidably, too often already. Their general character may be understood by saying that they consist of rocky bases of greater or less elevation skirted by sandy shores. In general they possess the best pastures on this coast, being little encumbered with peat; and as they are for the most part low, the quantity of naked rock is much less than is usually observed throughout this country. They are all very productive of sea-weed, from which great part of their revenues are derived. Wherever I examined the rocks I found them to consist of gneiss with no varieties worth recording.

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* For the names of these the reader may consult the general Map.

HARRIS.*

The northern half of the outer chain of islands is separated, as was lately shown, from the southern, by the sound of Harris, and is divided into two districts, the Lewis and the Harris, which however form but one island. This island, which appears to have no appropriated name, is nearly intersected at the point called Tarbet by the indentations of the eastern and western seas; a natural division which does not coincide with the political one, since that is denoted by an irregular line drawn from the middle of Loch Seaforth to the end of Loch Resort; being the same which forms the line of demarcation between the two proprietors, Seaforth and Macleod of Harris. It will be most convenient to describe each division separately, although there is no point where the physical constitution of the two can be said to change.

Harris is of an irregular form resembling the three quarters of a square, its diagonal length being about twenty-four miles, and its breadth about seven. It presents a coast every where deeply intersected by sea lochs, which, as is usually the case in this country, are interspersed with islands and rocks. On the east side, nearly the whole shore presents this character, few slopes descending into the sea, and scarcely a beach or sandy bay being visible throughout its whole extent. Numerous harbours are formed by these lochs; while the intricacy of their sinuosities offer shores resembling in length and complication those already described in Benbecula and North Uist; with this difference however, that the islands and cliffs which form them are considerably higher, and often indeed approach to the mountain character. These rocks are bare, or sprinkled with rare and scanty patches of verdure, which, when of somewhat continuous extent, are generally inhabited by solitary tenants, subsisting by the double occupation of farming and of manufacturing kelp.

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* Pronounced Earradh by the Highlanders. This word signifies a division. Ear, a head, (Gaelic) may also be the origin of the present name, which is a modernized one.

The intricate admixture of land and water, the occasional height and magnitude of the masses of rock, the unceasing variety of their forms and positions, and the magnificence of the screen of mountains by which this coast is backed, produce together a mass of picturesque scenery offering frequent and tempting subjects to the pencil of the artist. The scenes are often such as to remind him of the well-known and romantic recesses of Loch Ketterin,* and only require like them the ornament of trees to rank amongst the most picturesque parts of Scottish landscape. But art and Nature conspiring have denied to Harris this necessary appendage of landscape as well as of rural economy, since not a shrub of higher claims than heath is to be found throughout the whole country. There is a period in civilization when wood is destroyed and there is a succeeding one when it is planted. But there is a long interregnum of severe want between these, and that interval is no more terminated in many parts of the main land of Scotland than it is in the shelterless plains and naked mountains of the Long Island. The proprietors would fain believe that there are physical obstacles to its growth, and thus conceal from themselves those moral causes the contemplation of which is attended with self-accusation; like those who in adversity argue themselves into a belief of fatalism to quiet the remonstrances of their own reflections. There are no physical obstacles, or none at least which Norway with a great similarity of feature, exposure, and rocky substratum, accompanied by a more severe climate, has not overcome.* Innumerable situations adapted to the growth of trees are to be found in the sheltered valleys and on the lee sides of hills; while the islands so plentifully scattered along the coast are calculated to remove the fundamental obstacle to planting, namely, the expense of enclosure. One of the main difficulties to be surmounted, is, in fact, the want of capital to expend on improvements from which the returns are not immediate, and the wants, real or imaginary, of the landed proprietors, who are too often intent on procuring from the soil the utmost immediate rent which it can be made to afford. To these causes I may add the non-residence of the proprietors, who can not be expected to interest themselves in ornamenting those paternal seats from which they derive no pleasure. Even among those who actually reside, that indolence, so characteristic of the inferior classes of Highlanders and from which the superior are not wholly exempt, is a perpetual bar to improvements of this nature. In a proportional degree, a Highland gentleman is as little anxious to multiply his enjoyments as his tenant, whose domestic animals dispute the fireside with himself, and whose smoke, for want of other vent, must find its exit at the door of his miserable hut.*

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* The etymology, and consequently the spelling, of this name is so often mistaken that it may as well be rectified. *Cath-earn*, the *th* being dormant, men of war, or soldiers. Hence, following the orthography, Caterans, Ketterins; the Quatrani of Fordun. Kernes, which follows the Gaelic pronunciation, is the well-known appellation of the Highland freebooters as used by Shakspeare, of which this lake from its vicinity to the Lowlands and the security of its trackless recesses, was a favourite strong hold. Hence the obvious impropriety of Loch Catherine.

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* It is imagined that the oak will not grow to a large size but in a good soil. Among many remains of oak forests in Scotland, there are still remaining alive at the head of Loch Etive some trees from twenty to twenty-five feet in circumference growing out of granite rubbish. In such situations the growth is undoubtedly slow, but the dimensions do not seem to be so limited as has been often supposed.

On the southern side of Harris the hills are more clothed with earth and descend by more gentle slopes to the sea, in consequence of which an interrupted tract containing some good land is found along this coast. A road is formed in this direction, perhaps the only one practicable or even likely to be useful throughout the country. The west side, as far as Loch Tarbet, is marked by some accumulations of sand similar to those which abound in the islands already described, one considerable tract of which separates the hill called Toe Head so as to insulate it from the main island. West Loch Tarbet is a deep intersection between high mountains that rise on each side and descend by very steep declivities to the sea; the land at its lower end being reduced to so narrow a neck as to admit of the carriage of boats from the west to the east side of the country. The whole circuit from this place to Loch Resort is of similar character, the mountains descending directly to the sea and generally terminating in a level shore indented by small bays and lochs. The boundary towards Lewis is merely an imaginary line holding an arbitrary course through an irregularly mountainous country.

Such is the coast line. The interior of the country is one irregular group of mountains placed without order or connexion; of very unequal elevation but generally high, and containing indeed some of the highest hills in Scotland. In this respect the character of Harris is entirely different from that of the islands immediately to the south of it. It probably does not any where contain twenty acres of level land in one spot. There is not at least a plain throughout the whole country, mountain following mountain in continual succession, uninterrupted even by that common feature in Scotland, the green glen or alluvial strath. The only land which at all approaches to an even surface, lies on the sandy shores of the western coast. The greater number of these mountains display surfaces of naked rock; the same rock with the same general outline and aspect already described in the islands to the south. It is difficult indeed to form a conception of greater desolation and barrenness than is seen from the summit of any of the high mountains in this country; entire surfaces of miles in extent appearing to consist of bare rock scarcely checquered by a spot of verdure, or even of that pretence to verdure, a mossy moor. Such is the case more particularly with Roneval, one of the highest mountains. In some places however, chiefly on the western and southern sides, there are declivities of tolerable pasture; and similar patches are here and there scattered throughout the country wherever the declivity is such as to favour the accumulation of earth, and at the same time to repulse the lodgment of water and the consequent accumulation of peat.

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* The following example is characteristic. An Highland estate was given in lease for 200 years to a cadet of the family, as a reward for military services, under the sole condition of delivering it at the expiration of the lease with a specified number of growing trees of a certain age, and under a determined fine for each tree deficient in the required age. That lease is on the point of expiring and as yet not a tree is planted. When I visited it not long ago the lessee informed me that he meant to plant to-morrow. He had been twenty years in possession, and his predecessors for five or six generations past had probably all like him intended for the last 200 years to plant "to-morrow."

In similar situations, almost exclusively limited to the sea shore, is dispersed the population, in which this country like the greater part of the Highlands abounds, the small patches which admit of the plan of cultivation followed in most parts of the Highland maritime districts, being occupied by distinct families or held in joint tenantry, according to their several capacities. A few large pasture farms have been lately allotted, but the greater part of the land is held according to the plan till lately most prevalent in the Highlands, and formerly mentioned by the name of run-rig. To a stranger, the mode of cultivation in use in these rocky districts presents a very singular aspect, in the sinuous ridges and minute patches occupied by corn or potatoes, which grow upon artificial beds heaped on the naked surfaces of the rock. By this almost Chinese system the shallow soils found on the rocky substratum are rendered productive; the accumulation of the beds increasing the earth to the necessary depth; while the intervals between them, produced by the removal of the required portion, become the drains, which in a climate so moist and in soils of such a composition, are the first steps towards cultivation. As far as this system is faulty, it is here only so on account of that waste and misdirection of industry already noticed in the remarks which have preceded: if it is right that such land should be cultivated, no better plan could be devised. But it is extended also to cases where it is by no means the best system that might be adopted, and where, on the contrary, the same quantity of industry bestowed in a different manner would produce more effectual and more permanent improvements. I allude to the very common practice of constructing similar beds on peat mosses where there is a great depth of soil. By this practice a certain extent of surface is brought into cultivation by a method of drainage which is laborious while it is neither permanent nor extensive; it being obvious that the same quantity of spade-work applied to the construction of well-directed and deep drains, would unwater the whole space, whereas, in this practice, no portion is drained but that heap which has with much toil been thrown up on the surface.

In Harris, as throughout these islands, the best soil and consequently the greenest pastures, are found on the sea-shores. In consequence of the vicinity of the sea being unfavourable to the formation of peat, the soil in these places, instead of being encumbered, as in the interior, with an inert mass of this substance, is clothed with the Festucæ, Airæ, and other grasses which usually affect similar situations. I have shown that in the southern islands this often depends on the admixture of sand, but it is also to be seen here as well as in Lewis, in situations where no sand is found. While on this subject I may remark, that there appear to be much greater accumulations of clay in Harris than even in North Uist, producing in many places an excellent soil capable of an almost constant system of culture. This accumulation is very remarkable even on the summits of the hills, where it often forms beds of a foot or more in thickness, which, when unencumbered with peat, produce excellent grasses, unless where elevated into too high a region. This earth, like that of North Uist, is extremely fine and soft, resembling porcelain earth when free from the black colour it sometimes acquires from the peat, and evidently derived from the decomposition of the felspar which abounds in the gneiss. In many places it is so mixed with the decomposed peat as to form a perfect black mould.

I observed but few alluvial accumulations of greater note than this; no banks or beds of mixed stony and earthy matter, nor any of those deposits which mark the effects, either of distant revolutions of the surface, or of the more recent action of water. The want of recent accumulations may be accounted for, as in the adjoining islands, partly by the want of rivers and torrents, and partly by the extremely durable and refractory nature of the rock. In this respect Harris, as a mountainous country, presents a character somewhat remarkable in Scotland. The deficiency of running water is not the consequence of a want of rain, since the climate is considerably more rainy than that of any part of the Long Island, the mountains being frequently involved in clouds for many days, when the country both to the north and south is enjoying a serene atmosphere. It appears to depend partly on the mode in which the mountains are grouped, and partly on the want of those fissures in the rock which are necessary for the production of springs. Hence every shower is speedily conveyed over the surface to the nearest hollow; where it almost immediately finds a passage into the sea, scarcely any number of small streams uniting into a larger river. Those at Rowdill and at Loch Resort appear to be the most considerable. Occasional torrents carry but little waste with them; often indeed there are scarcely any fragments to be found on the faces of the hills, or they are thinly scattered over the firm rocky surface. In this respect the hills of Harris, as well as those of the Long Island in general, present a marked dissimilarity to those of quartz rock, of granite, of syenite, or of porphyry, that are found in various parts of Scotland, the waste of which is rapid and constant. That character which is so striking in the greater part of the Long Island, the abundance of fresh-water lakes, is equally wanting in Harris. As there are no plains, there are consequently no places where such waters can accumulate; and the few mountain pools that occur are no more frequent than in other mountainous parts of Scotland.

It need scarcely now be observed, that a country such as is here described, where unsurmountable rocks and impassable bogs alternately claim the mastery, cannot be traversed with much ease. There are indeed many parts which have probably never been trodden even by the shepherd's foot. I nevertheless succeeded in ascending such mountains in different places as to be enabled to give an estimate of their altitudes sufficiently accurate for all common purposes of topographical description. Such measurements do not appear of any great value in a geological view, as the successions and relative positions of rocks are totally unconnected with altitude of place. Every observer will find daily reason to reject the doctrine of the relative levels of the exposed edges, or *outgoings*, as they have been called, of the several classes of rock. This is an example, among numerous others, of premature induction in the science of geology, and deserves not to have its existence prolonged by a formal discussion.

The altitude of the mountain Lang, one of the highest of the group which bounds the north side of west Loch Tarbet, was 2407 feet, as taken by the barometer. A storm and the coming on of night together, prevented me from traversing the precipices to be surmounted between this and the next highest summit, that of Clisseval. By various modes of estimating it both near at hand and at a distance, from different points, it appeared to be at least 300 feet higher: it may even be more. This is very obviously the highest hill in Harris, or indeed in the whole chain of the Long Isle, its pre-eminence being every where distinctly visible. From this, as the centre of the highest group, various other hills, the names of which I could not discover,* descend by gradual stages to Loch Resort on the one hand, and to Loch Seaforth on the other; two or three of the neighbouring summits attaining nearly the same height as that of Lang.

The hill of Roneval, which lies above Rowdill, is the next in elevation. The violence of the wind prevented me from finding the true level of the barometer,* but it appeared to lie between two points which would give the limits of height each way as 2200 and 2500 feet. This mountain forms one prolonged ridge, and is somewhat insulated; from which cause it is the most conspicuous feature on the east side of the country. The remainder of the southern division as far as Tarbet, is of much less elevation than the group already described as forming the northern half; and may be conceived to vary from 2000 to 1000 feet, declining from the centre of the country on each hand, both towards the eastern and the western shores.

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* It is not intended as an excuse for neglect, to say that such local information cannot often be obtained. He that is contented with a first answer in the Highlands will indeed never be at a loss for at least the appearance of information. Unfortunately it will seldom bear a scrutiny, a second question generally rendering void the effect of the first. "How long is this Loch?"—"It will be about twenty mile."—"Twenty miles! surely it cannot be so much."—"May be it will be twelve."—"It does not seem more than four."—"Indeed I'm thinking ye're right."—"Really you seem to know nothing about the matter"—"Troth I canna say I do." This trait of character is universal, and the answer is always so decided, that the inquirer, unless he is a strenuous doubter, is not induced to verify the statement by this mode of cross-examination.

Such is the general disposition of Harris. Its geological history is comprised in a narrow compass, as the reader must be prepared to expect, since it was already said to be a country of gneiss. I have had occasion to describe so often the chief characters of this rock, that I shall here only notice those peculiarities which occur in this tract of country, and those mineral substances or rocks which are associated with it. It is probable that something is still left undiscovered, amidst its almost inaccessible deserts, to reward the toils of future geologists.

A remarkable variety occurs at Curihunish point. This consists of a nearly equal granular mixture of argillaceous schist with felspar and a little quartz, having the aspect of a grey granite, since the laminar tendency is barely discoverable. It is disposed in immense squared masses very much resembling the granites of Arran and Dartmoor, and in forms so regular and rectangular as scarcely to require the aid of the tool to render them fit for masonry. They are all so loose as to be readily moved by the lever, and would form an admirable quarry for architectural purposes where large masses were wanted, should any demand for such works occur in a situation where they could be conveniently obtained. In Roneval* also the gneiss, as in many places already described, loses, in part or entirely, the laminar character, becoming thus scarcely distinguishable from granite. Hornblende is here abundant, and in the same specimens are numerous large garnets often possessing an imperfect degree of transparency. In some instances the garnet is not separately crystallized, but so equally diffused through the rock as to give the whole a dark crimson blush. Among the veins of granite are found beautiful examples of the graphic variety, of which the felspar is white, translucent, and nacreous, acquiring after exposure an argentine brilliancy.

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* Every mountain barometer should be provided with a screw for securing it firmly in the gimbals in the perpendicular position. Without such a contrivance the instrument is nearly useless in windy weather.

Trap veins, or indications of them, occur in Harris, but they are not abundant. The most remarkable which I observed is on the top of Roneval, being 20 feet wide, vertical, and lying in a north westerly direction.

At the foot of Roneval a low irregular ridge of limestone is found extending in an interrupted manner for a mile or more towards Loch Rowdill. A church of ancient and tolerable architecture, formerly the church of the monastery of Rowdill, and one of the very few buildings which time and the Scottish reformation have spared, will guide the mineralogist to the spot where it is most easily observed.† It lies among the gneiss, and is often accompanied by a sort of micaceous schist, the position being irregular, but generally vertical. It is of a character very strongly resembling one of the varieties found in Tirey; being of a pale or dark grey colour speckled with darker spots of the same, and sometimes even verging to a blue; more rarely greenish, and containing specks or large pieces of transparent serpentine. At times it contains grey and watery sahlite or dark green coccolite, either dispersed in grains or intimately blended with the general mass, or lastly aggregated into lumps: it also contains mica disposed in a similar manner. Hornblende also occurs in it as in that of Tirey, in large concretions, but is more rare than the sahlite. On the shore at Rowdill, and in various other places, green compact felspar is found, forming an integrant portion of the gneiss, and often in very large masses. This substance is very prevalent throughout these islands, as it is in Tirey, Coll, and Iona.

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* The level surface of this mountain presents a singular instance of the force of the wind; the fragments that cover it, often of considerable size, being disposed in prolonged ridges divided by distinct furrows in the direction of the prevalent western gales; the beginning of each ridge being determined by the shelter of some fixed rock.

† The church of Rowdill presents some peculiarities in sculpture well worth the notice of an antiquary, and from their analogy to

But among the simple minerals to be seen in Harris, felspar, as might be expected, is the most conspicuous. It forms distinct concretions in the gneiss, often of very large dimensions, and appears under a great variety of aspects. It occurs in very large masses of a pearly lustre, and semi-transparent, accompanying the graphic granite before mentioned, and forming specimens of great beauty. From this it is found gradually tending to the more common foliated variety, and at length approaching to the aspect of the compact kind, while its colour passes through various stages of ochre-yellow to a deep flesh colour. On that side of Roneval which faces Rowdill there is a vein of quartz of a rare variety and of great beauty. It is chiefly granular, emulating the

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certain allusions in oriental worship, objects of much curiosity. They are hence unfit for notice in a work of this nature. Any remarks would moreover be superfluous, as they will probably in no long time receive illustration from a pen to which the public has lately been indebted for a great part of its amusement.

finest sugar as well in the splendour of its colour as the minuteness of its texture, but passes by degrees into the compact form.

Sahlite is the most interesting mineral found in Harris, where it is scarcely less various in aspect or less abundant than in Tirey. It has already been observed that it occurs here in the limestone, as it also does in Glen Elg, in Glen Tilt, and in Tirey; either occupying distinct cavities, or else firmly imbedded in the rock. It is sometimes crystallized in very flattened rhombic prisms with curved sides and summits; the latter being dihedral, and the crystals of an inch in length. It is also found in irregular flattened hexaedral or octaedral prisms, most generally imbedded in the limestone. The colour is various, being either black, white, grey, greenish, or brown, two or more of these differently coloured concretions occasionally combining in the same mass. In texture it is sometimes opake, while in other cases it approaches to the vitreous aspect, exhibiting at the same time all the intermediate modifications. One variety is deserving of notice from its resemblance to a mineral to which the name of bronzite has been applied, and which, according to Hauy, belongs to the species diallage. This is of a clear umber brown, with somewhat of a metallic splendour, the structure being lamellar and approaching to the fibrous. In other respects it has the character of pyroxene, the angles of the integrant prism measuring 88° and 92° nearly; whereas those of diallage are almost equal, the more obtuse angle not much exceeding 90°. It is not unlikely that a further investigation of the several minerals classed under these different species may throw light on a subject at present somewhat obscure, and lead to the more accurate classification of some substances of which the affinities are as yet uncertain. The other form of the sahlite or pyroxene here occurring, is that of coccolite, or a congeries of independent and ill-determined minute crystals. These are sometimes distinctly imbedded in the limestone, as in Tirey, and of different colours, brown, black, greenish, and grey; while in other cases they form separate masses adhering together in a granular distinct manner, and impressing each other like the grains of the pomegranate. The brown variety above mentioned is occasionally found in this manner, and being sometimes further intermingled with scales of mica, it forms a compound of a highly splendent and singular appearance.

The last observation is almost too imperfect to be mentioned, excepting as it may point out a defect to be supplied by some other observer. It relates to asbestos found in the neighbourhood of Nishishee, on the western side of the country, and derived probably from some bed of serpentine which I did not discover. Chance must often combine with industry in finding those minerals or beds of rock which occupy so small a space in a district of this difficult nature.

SCARPA, TARANSA, SCALPA.

These three are the only detached islands of considerable size connected with Harris: in a geological view they may be considered as portions of it. The substances found in the two latter render them worthy of notice, although they present too little variety to call for a detailed consideration.

Scarpa and Taransa are each mountainous, the former consisting of one rocky mountain of gneiss about 1000 feet in height, and the latter, of two hills of less elevation connected by a sandy isthmus. I discovered nothing in Scarpa worthy of particular regard, but the granite veins of Taransa are conspicuous for the magnitude and beauty of the crystals of mica which they contain. The smaller are generally very regular, and are crystallized in short prisms or tables, often two inches in their long dimension: the larger are less regular, attaining to nearly a foot in length. They are rarely found so large in Scotland.

Scalpa, or Glas island, situated on the eastern coast, is conspicuous for its light-house, being low, and, like all the rest of this shore, formed of irregular protuberances of gneiss. To the geologist it is remarkable for a bed of serpentine, which the works required for the light-house have so far laid bare as to render it of very easy access throughout the whole of its connections. It traverses the promontory on which the light is erected, being, like the gneiss in which it lies, very irregular in disposition, but generally placed at a high angle, often indeed in a vertical position. At its boundary it in some places passes into a schistose rock, not easily distinguished at first sight from clay slate, and consisting of a smooth mixture of talcose schist with hornblende. In other places the boundary between the gneiss and the proper serpentine, is a serpentine so full of hornblende in large crystals as to be distinguishable with difficulty from a hornblende rock. Some of the varieties have a schistose aspect and fissile structure, their colours being likewise disposed in a laminar manner, so as to present a dark greenish basis, striped, and in some directions speckled with a paler tone of the same colour. These generally lie near the gneiss, the interior gradually assuming a more massive form, and displaying at length a fracture from which all appearance of foliated tendency has vanished. Talc slate is also occasionally found at the limit of the gneiss, mixed more or less with quartz of a very greasy aspect. In the interior of this bed, of which the thickest part may perhaps be estimated at 100 yards, a body of potstone is found, the harder serpentine passing into it by gentle degrees. The fine edge of its fracture is somewhat translucent, like wax, and it is of a dark green colour. The serpentine contains, as is not uncommon, veins of dark green and of pure white steatite, sometimes fibrous, together with splendent veins of greenish asbestos. It offers no specimens of an ornamental nature. There are some peculiarities worthy of notice in the gneiss which accompanies it. In some parts this is almost a mere mass of felspar with a splintery and granular fracture, and mottled with red and white; the laminar disposition being marked by these alternations of colour. Sometimes it is interlaminated with clay slate, and more rarely with talc, forming a talcaceous gneiss, a rock which I have only observed in this place and which serves to mark the connexion between the serpentine and its boundary. A more remarkable phenomenon is offered in the passage of the granite veins. They traverse the serpentine as well as the gneiss, in the former part of their course assuming a peculiar character, consisting of the usual mixture of quartz and felspar with talc superadded; a proof that in this case at least the vein is influenced by the substance through which it passes. Another variety of the gneiss occurring in this singular spot is also worthy of notioe. It has the character of graywacké, consisting of an argillaceous base with imbedded grains of quartz and felspar. I have already shown on different occasions that micaceous schist as well as talcaoeous and chlorite schist form beds in gneiss, and that even clay slate does the same: in this instance the rule may also be said to extend to graywacké.

Trap veins are not wanting in this island, since a very large one of a laminar structure is found in a vertical position crossing the gneiss.

Lastly, I may add to this account that small particles of chromat of iron are found dispersed in the serpentine.*

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* When in this island, a shoal of bottled-nosed whales amounting to some hundreds had been forced ashore and taken. They are very abundant in this sea in the autumnal season, following the herrings. They appear to pay that implicit obedience to a leader which is so remarkable among land animals, in the deer, and in the duck tribes. By this they are taken, since, when the head fish of the shoal has been driven on shore by the boats, the whole follow until they take the ground; when their retreat is easily cut off.

LEWIS.*

In the description of Harris I have said all that is necessary for distinguishing the boundary between the Lewis and that district; the two, as I then remarked, forming but one island. The total length of Lewis is forty miles, from the boundary line to the Butt, and its greatest breadth, between Ru Ushenish and the Gallan Head, rather more than twenty. The outline of the coast is much more regular than those of the preceding islands; as it offers only one considerable indentation on the western side, and as the northern half scarcely possesses one of those inlets which, in the others, form such numerous and commodious harbours. The same continuous disposition of the coast is also the reason why the shores of Lewis are so little encumbered with rocks: a circumstance which renders their navigation more easy, and comparatively free from risk. The coast-line is so different in character in different parts as to admit of no general description.

From Loch Resort to the Gallan Head it consists of the declivities of a high group of mountains, terminating either in slopes and stony shores or in rugged and precipitous cliffs. At the Gallan Head the great sinuosity containing Loch Bernera, Loch Roig, Loch Carlowa, and other subordinate indentations, commences. This intricate inland sea, the largest in the Long Isle, is sprinkled with numerous islands, many of which are of considerable magnitude, the largest, Great Bernera, being about six miles in length. The loch is thus hollowed into bays and interrupted by passages of such variety and intricacy, that it requires no ordinary degree of attention and of readiness in discerning the true nature and bearings of land under such circumstances, to effect its circumnavigation. With the chart it is sufficiently difficult; without that, it would be almost impracticable. The entrance of Loch Roig in particular is so obscure that a boat may pass within a few hundred yards of the entrance without perceiving it.[*] Intricate and entertaining as this navigation is, it cannot be called picturesque; as the land is in general low, with the exception of the southern mountains, which are seen at a distance towering above the Kyle Flota. The cliffs also which bound most of the islands and shores, are rugged, without beauty and with little elevation. Like all the cliffs of gneiss in these islands, they are broken into a number of minute and angular parts, which destroy that repose and breadth so necessary to the picturesque; while the capricious and gaudy distribution of colour which they derive from the intermixture of red and white granite with hornblende and common gneiss, interfere with tranquillity of tone as much as their fracture does with that of form. One or two detached rocks may perhaps be exempted from this general remark; and of these, Gariveilan, placed at the mouth of the loch, is the most interesting; displaying a detached arch of great height with considerable simplicity and grandeur of effect.[†]

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* This name, like many others, has been a stumbling block to Gaelic etymologists. It has been derived from Leod, Loda, the Scandinavian Divinity. It is commonly used with the article; The Lewis.

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[*] It is amusing to observe the various grounds on which reputation is founded in different societies. The contempt with which the anxious, and often perilous, pursuit of "chucky-stanes" (pebbles), was viewed by the seamen, was suddenly converted into respect when the "Saxon" geologist was obliged to take the helm and bring back to the anchorage the boat which themselves could no longer guide.

[†] A voyage through the narrow channels of these sea lochs is often attended by very picturesque circumstances and striking effects. On one occasion the water was like a mirror, but black as jet, from its depth and from the shadow of the high cliffs which overhung it. The tide, flowing with the rapidity of a torrent, glided past without a ripple to indicate its movement, while the sail aloft was filled by a

A rocky shore with cliffs of unequal but moderate height and of similar character, interrupted by some sloping declivities, extends from here to Barvas; whence to Ness a low shore is seen with a gentle and often alluvial slope, frequently terminating in a flat sandy beach. The rocky cliffs which form the northernmost extremity, commonly called the Butt of the Lewis, rise to the height of sixty or eighty feet, and are continued with slight exceptions as far as Kneep Head, where they are succeeded by low shores reaching, with the exception of the Aird, to Stornoway, the capital of this western land. At the Butt these cliffs are broken into rugged forms of an aspect peculiarly savage, being at the same time hollowed into innumerable caves into which the western swell beats with almost incessant violence and noise. Arches and pillars detached by the power of this turbulent sea, form a series of objects from which a painter might select detached parts with great effect; but the whole is unpleasing to a cultivated eye: there is too much of that which, sparingly used, is conducive to the most powerful effects in painting as in poetry. Near Stornoway a large tract of sand occurs on the shore, from which a peninsula called the Aird stretches towards the north-east, forming a low table land bounded chiefly by rocky cliffs. Loch Stornoway offers nothing remarkable but the excellence of its harbour, and from this to the Birken isles the coast resembles the rocky shores already described; displaying one continuous and rugged face of gneiss. Loch Luerbost, like Loch Bernera, consists of a deep indentation sprinkled with islets, extending to within a few miles of Loch Kenhulavig, the eastern extremity of Loch Bernera, so as almost to intersect the land in this direction; as it also does towards the head of

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breeze that did not reach the surface. There was a death-like silence while the boat shot along under the dark rocks like an arrow: to a poetical imagination it might have appeared under a supernatural influence: like the bark of Dante, angel-borne.

Loch Seaforth. Whatever claim the Birken isles may once have had to their name, they must long since have lost it, since neither birch nor any tree except a few stunted plants of Populus alba is to be seen through the whole extent of Lewis.

Passing Loch Hourn the cliffs increase in height, the Kebock Head attaining an apparent elevation of 150 or 200 feet, but with a similarity of character to the preceding, while the interior land begins also to rise into that mountainous group which forms the southern part of this district. The mountain character, which had disappeared at Loch Bernera, now once more becomes predominant; the land above the coast rising immediately into hills of considerable elevation which descend with rapid slopes and often inaccessible abruptness into the sea, while they often terminate on the shore by high and craggy cliffs. Loch Shell, Loch Valumis, and Loch Brolum present, from this cause, inlets of considerable grandeur, resembling those which abound on the west side of the main land: but the most magnificent scenery of this coast is found at the entrance of Loch Clay, and in the bay which is the common opening of Loch Seaforth and Loch Trolamarig. The mountains here rise to a great height, and together with much grandeur of outline, form groups of highly picturesque composition. The course of Loch Clay is but short, while Loch Seaforth penetrates upwards of twelve miles inland, losing at length the mountain character which so strongly marks its opening to the sea. Here the coast line of Lewis terminates.

The general aspect and face of the country is such as to admit of a very natural division into two portions, of characters quite distinct, although not divided by a strong line. The group of mountains which surrounds Clisseval continues across the common boundary of Lewis and Harris without change of character; branching away at length in a crescent-like form on the east and west sides, and maintaining in these directions a considerable altitude, while in the centre it declines more rapidly into a set of lower elevations between the heads of Loch Roig and Loch Seaforth. By degrees it subsides into an undulating and uneven land towards Loch Kenhulavig. The mountains on the west side, between Loch Resort and Loch Bernera, are however higher than those which lie from the entrance of Loch Seaforth to Loch Shell, and when viewed in different directions, whether from the sea, from the high lands in the interior, or from the highest summits of Harris, seem no way inferior to them in elevation. From these various positions, assuming points where the principal summits were at equal distances from the point of observation, I concluded that Suaneval was early equal in height to Clisseval in Harris, which, as already shown, was found to be 2,700 feet. As there is no map of this country * I found considerable difficulty in procuring the names of the mountains, and shall therefore mention no more of them; observing merely that the other hills connected with this principal summit decline from it by very slow degrees till they terminate at the Gallan Head and the Kyles Flota. On the east side the altitudes are decidedly inferior, although these mountains also are in the first class. I can give no actual measurement of either range, as the disturbed state of the weather prevented me from ascending those few which are accessible.

Few hills are to be observed in Lewis after the termination of this mountain district. A group of no great extent, and not reaching apparently to 800 feet in height, is seen on the north side of Loch Bernera. Shortly after this subsides, the hill of Barvas rises in the same direction to a similar elevation. This has a tame rounded outline and a moory surface interspersed with rocky patches, declining by an insensible gradation into the

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* That in Arrowsmith's work is, like many more of the Western islands, a mere outline, and a very incorrect one, apparently copied from the sea charts.

general irregular level of the country. Still further north is seen the similarly rounded and low hill of Munach, owing its importance, like the former, to the almost level surface of the land by which it is surrounded. In the vicinity of the southern group both Munach and Barvas would be undistinguishable. With the exceptions now mentioned, the whole land of Lewis from the termination of the southern group to the Butt, is low, partaking of an irregular undulation in the vicinity of the hills, and subsiding into an uneven table land towards the northern extremity.

The soil varies as the elevations change. While the summits and sides of the high hills are naked and rocky, the plain land is clothed with a thick bed of peat, obscuring almost every where the rocky substratum, or only suffering it to break through in occasional protuberances. The aspect of this interior level is that of an universal, desolate, brown moor; pastured in the summer months, and in the winter almost impassable to man or animals.* Towards the sea, as is generally the case, green pastures are found, and here also some tracts of alluvial land of considerable extent occur, affording an excellent soil. The best of this land lies at the northern extremity, and, wherever situated, it is the sole receptacle of the great population by which the Lewis like the rest of the Long Island is crowded, may I add, encumbered.

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* The deserted state of this tract is the result of its barren surface, but in general the present uninhabited parts of the Highlands have been unavoidably reduced to that condition by the system of sheep-farming. Thus many of them have been rendered nearly or altogether inaccessible to a traveller, from the want of houses where he may obtain shelter. It is not uncommon now to go thirty miles or more without seeing the trace of human existence. To the solitary wanderer, the deserted patch of green land in the mountains, or the abandoned valley with its ruined huts, presents an aspect peculiarly melancholy; while he is often at a loss to explore his way, the tracks which formerly conducted to those villages having been effaced by want of use.

Although the surface of the interior country is every where a brown peat, it is in many places more susceptible of improvement than similar soils in the neighbouring islands. This superiority does not arise from climate, since there is no sensible difference between this country and the other parts of the chain; if we except the very mountainous district of Harris, which is subject to an undue proportion of rain. The clay which lies above the rock is here more generally diffused and in greater abundance than in the southern islands; while the thinner covering of peat on the undulating land renders access to it more practicable, so as to admit of its being turned up by the operations of agriculture. But the chief causes are, the form of the land and the frequent receptacles of water, which render it capable of being easily drained; an improvement almost denied to the flat moory tracts of the southern islands. The progress of wealth may perhaps some day effect a change; it may even be gradually carried into practice by the industry of the larger tenants and small crofters, if due encouragement be given to their exertions, and the preliminary of draining, (an operation from its expense impracticable by them,) is either adopted by the proprietor, or enforced under some regulation so directing the divided labours of the tenants as to make them tend to a general plan of drainage. It must nevertheless be remarked that this island has been for some time in a state of gradual improvement; while a stimulus is also given by the increasing wants of Stornoway and by the roads now forming in different parts, from which a further extension of it may be expected. It is to the want of capital that we must look for the abandoned state of many promising tracts of land throughout this country. Divided as that capital is, it must be applied in the present manner or cease to be applied at all. It cannot now be extended to a wider and more profitable range of objects, because it can neither be accumulated under one comprehensive plan, nor wait the slow returns which must ever follow the first advances in objects of this nature. Let the spectator who admires the industry of the small tenants, turn his eyes from the little rocky croft of the laborious farmer, to the wide, undrained, unenclosed, and unproductive moor, and there he will find Nature languishing for want of that attention which bestowed on worse subjects supports the crowded population of this country. He will then perhaps exclaim against the want of industry which suffers to lie waste, tracts of land capable of yielding great resources and of maintaining a great increase of the present population. But I need not dwell on this subject, the remarks made throughout various parts of this work being sufficient to convey a general idea of the political and agricultural state of these islands.*

There are some circumstances in the population of Lewis connected with the ancient history of these islands, which are not to be observed elsewhere among them, nor perhaps any where so distinctly throughout the Highlands. A few remarks on these may not be unamusing to the reader, who can scarcely fail to have acquired some interest in the general history of the Western islands independent of that which arises from their physical structure.

Numerous fishing boats are generally to be seen about the Butt, manned each by nine men rowing eight oars in double banks, a practice nowhere else to be observed. The people themselves are also strikingly dissimilar to the general population of the islands; preserving their unmixed Danish blood in as great purity at least as the inhabitants of Shetland; and probably with much of the manners and appearance of the times when this country was an integrant part of the Norwegian kingdom. They constitute even now an independent colony among their neighbours, who still consider them as a distinct people, and almost view them in the light of foreigners. The district which they possess is by far the most fertile and valuable part of the island, and they occupy it in the ancient slovenly system of joint tenantry. They are reputed industrious fishermen, but they only fish for their own consumption; appearing to abound in food, as they are all fat and ruddy. They possess almost universally the blue eye and sanguine complexion of their original ancestors, and with their long matted hair never profaned by comb or scissars, can not be distinguished from the present race as we still meet them manning the northern ships. Notwithstanding their rude aspect and uncouth dress, they are mild in manners, and are esteemed acute and intelligent. It is perhaps a remarkable circumstance that they retain no peculiar traces of the northern tongue; and indeed that throughout a country half peopled by the descendants of Norwegians, and where almost every local name is of northern origin, so few remains of the language should now be found. In this instance at least, the existing language offers no clue for tracing the revolutions of tribes, whatever lights may be derived from topographic appellations.

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* This district still possesses one of the ancient peculiarities now extinct in almost all the other islands, and indeed nearly so every where. This is the employment of tacksmen, of whom there are thirteen. It is unnecessary to discuss here the comparative advantages and defects of a system so nearly abandoned. The southern traveller will also be surprised to see women still employed in drawing the harrow, and in droves, like horses, carrying the peat from the moors into Stornoway.

From whatever source these islands were originally peopled, and under whatever barbarous form of government their scanty population existed during the period in which the Romans held Britain, it is known that they were subjected to the piratical incursions of the

Norwegian rovers during the eighth century. It is probable that in the time of these incursions, settlements were formed, and some of those names imposed which still continue to predominate among the islands. Little certain information can however be procured respecting these invasions till towards the end of the ninth century, the period of the conquests of Harold Harfagre, and the subsequent revolt of Ketil; under whose sway a Norwegian government was consolidated in the Western islands. The new kingdom of Man, which immediately succeeded, absorbed within itself the whole of them; yet some obscurity hangs over the nature and extent of this sovereignty, as it appears, that although during the whole of this period they were subject to the kingdom of Norway, and were under the immediate command of lieutenants sent from that country, they payed tribute to the Earls of Caithness and Orkney. Antiquaries have vainly endeavoured to throw light on the obscurity of these times; but in truth the elucidation of the exploits of these roving freebooters, unless it may be supposed to derive some merit from its difficulty, seems as little interesting as the history of those who now roam through the islands of the Pacific ocean, brandishing the wooden spear and the war club. A gleam of light appears on the arrival of Magnus the bare-footed, who being called to the assistance of Donaldbane about the end of the eleventh century, conquered and laid waste the islands, consolidating his dominion over them and adding to it the peninsula of Cantyre. Between this period and the time of the battle of Largs, fatal to the Norwegian power in Scotland, they seem to have remained under the dominion of Norway, nominal at least if not real; since on several occasions it appears that its lieutenants or viceroys assumed the kingly title, and either renounced their allegiance altogether, or sought protection from England or from Scotland, as the politics of those days, not less intricate, if less important, than those of our own, might vary. The battle of Largs, fought in 1263, terminated in the cession of all the Norwegian possessions in Scotland to Alexander the Third, who thus acquired by treaty that which his predecessors had hitherto been unable to conquer or retain.

It is perhaps to a subsequent period that we must look for the introduction of the present language and the disappearance of the Scandinavian, if indeed it be at all capable of proof that the language of the aboriginal settlers was not the same Celtic as that spoken by the Irish and the Highlanders; the present Gaelic dialect. If this should be admitted, the difficulty of accounting for the loss of the Scandinavian is removed; since it is easy to imagine that the temporary and partial settlement of the country by the Norwegians had failed to produce a permanent or marked change in the language; and that the descendants of these conquerors, being the minor portion of the population, conformed in course of time, as the Normans did in England, to the prevailing tongue. The existence of local names of northern origin is compatible with this supposition. But I am aware that this is delicate ground, and that formidable antiquaries who imagine that they have traced the migrations of the Scoto-Irish and the more recent establishment of their dialect, to later periods, are in array against this supposition.

The history of the islands which follows the period of their cession to Scotland is better known and more popular; since it contains the rise of the great chieftains who so often resisted the authority and troubled the repose of the Scottish monarchy, and whose descendants are still the heads of clans not long deprived of their independence. The Macdougal and the Macdonald were the original chieftains who, by immediate descent from the Thane of Argyll and the King of Man, divided the whole of the isles between them, the northern becoming the kingdom of the Macdougals, and the southern that of the Macdonalds. For nearly a century, the history of these barbarous chieftains and their descendants is unknown, although there is sufficient evidence of their independence of the Scottish crown, at that time feeble and fully employed in maintaining itself both in foreign wars and against the encroachments of its own subjects. The year 1335 is marked by the open defection of John, Lord of the Isles, who with some of his immediate ancestors is also known by the title of Earl of Ross. The independence of this petty prince is proved by the record of a treaty formed with Henry the Fourth, and by the subsequent unsuccessful invasion of the north of Scotland by Donald his brother. During the remainder of the reign of James the First, and that of James the Second, inroads of the same predatory and barbarous nature were frequently renewed, and with various success; being always attended with atrocities of the most cruel description. On a subsequent occasion we again find the Court of England in treaty with the Lord of the Isles for his assistance in the conquest of Scotland, but this alliance was annulled by the change which took place in the policy of Edward the Fourth with regard to James the Third, the reigning Scottish monarch. James, thus at leisure, directed his attention to the conquest of this troublesome and rebellious subject; and in consequence of the submission of the Earl of Ross, he was reinvested with the lordship of the isles, but on condition of feudal acknowledgment and service. The period which follows this, presents a continued renewal of insurrection and rebellion, or of quarrels and battles among the petty chiefs, who appear to have acquired at this time a sort of separate independence, the origin, or the counterpart at least, of those family feuds that occupied the Highlands in general to a late period. These produced a state of perpetual war between various little kings; each of whom, supreme in his own territory, scarcely acknowledged the power of the sovereign who ruled the kingdom. The voyage of James the Fifth through the islands produced a temporary tranquillity; and the examples then made of several chieftains, whose names are on record, prove that the number of these independent sovereigns had considerably multiplied since the grant made by James the Third to the Lord of the Isles. That tranquillity soon ceased. After the death of James, fresh rebellions and a renewed state of anarchy arose, while the piracies and depredations of these ferocious people rendered them the terror both of Ireland and of the neighbouring coasts of Scotland. During these troubles the power of the Campbells, employed by the policy of the times against the chieftains, rose on their ruin, and among other deprivations, Isla was taken from the Macdonalds and granted by James the Sixth to Sir John Campbell of Calder.

The history of the commonwealth, and that of the reign of William III., still however show, that the same turbulence and the same notion of independence continued to prevail among the clans; but it is unnecessary to protract their history to a later date, as the termination of their independence and their reduction under the legitimate power of government have passed almost in our own times.

Such was the system that produced the feuds, the battles, and the massacres, of which every bay and every cave still furnish some tradition. Yet there are those who can look back with complacence to a history abounding with the most outrageous acts of cruelty; to a system compounded of tyranny and slavery, to perpetual war and famine and desolation; to the absence of all the arts, the habits, and the feelings of civilized life; the contempt of laws, and the most profound ignorance of all which distinguishes an European from a Cherokee. A change of terms is often the test of truth; and, in recollecting the realities of Indian warfare, the pleasing dreams in which we are apt to contemplate the feudal Highland government, evaporate.

The dearth as well as the unimportant nature of the antiquities found in the Western islands is such, that it is rarely necessary to allot much space to their description. The greater number of those which occur in Lewis resemble so nearly those described in other parts of this work, and are at the same time so little interesting, as to require no detailed notice. Its Druidical monuments are however numerous and remarkable, although hitherto recorded only in the imperfect accounts of Martin and in the equally unsatisfactory reports of the Statistical Survey.

It is well known that Scotland possesses numerous specimens of those structures which have been attributed to the Druids, but, with the present exception, they are, in the Western islands, both rare and unimportant. The neighbourhood of Loch Bernera contains many of them, and all comprised in a tract comparatively small, since a square mile would probably include the whole. They are situated in an open and fertile tract on the borders of this intricate inlet of the sea; and if they were really temples dedicated to Druidical worship, their aggregation would seem to imply that this spot was the seat of a college, as it has been called, of this order of priests; a Druidical monastery. Even in this case, the number crowded into one spot, in a country of which the population in ancient times must have been thinly disseminated, may be allowed to excite reasonable doubts respecting their real destination. But it is fruitless to speculate on subjects which seem doomed for ever to doubt and conjecture. I will however describe the most remarkable of these erections, since the magnitude and disposition of the work bespeak its former importance, and since its state of integrity renders it, after Stonehenge, among the most interesting which have been found in Britain. I have added an etching for the purpose of showing the general disposition more perfectly than words are capable of explaining it.*

The form is that of a cross, containing at the intersection a circle with a central stone; an additional line being superadded on one side of the longest arms and nearly parallel to it. Were this line absent, its form and proportion would be nearly that of the Roman cross or common crucifix. The longest line of this cross, which may be considered as the general bearing of the work, lies in a direction 24° west of the meridian. The total length of this line is at present 588 feet, but there are stones to be found in the same direction for upwards of 90 feet further, which have apparently been a continuation of it, but which having fallen, like others through different parts of the building, have sometimes been overwhelmed with vegetation, leaving blanks that impair its present continuity. The whole length may therefore with little hesitation be taken at 700 feet. The cross line, intersecting that now described at right angles, measures 204 feet, but as it is longer on one side than the other, its true measure is probably also greater, although I was not able to discover any fallen stones at the extremities; the progress of cultivation having here interfered with the integrity of the work. The diameter of the circle which occupies the centre of the cross is sixty-three feet, the lines ceasing where they meet the circumference. The stone which marks the centre is twelve feet in height. The heights of the other stones which are used in the construction are various, but they rarely reach beyond four feet: a few of seven or eight feet are to be found, and one reaching to thirteen is seen near the extremity of the long line.

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* Plate xxx. fig. 1.

The additional line already mentioned, extends northwards from the outer part of the circle, on the eastern side. It is however very defective, a great number of the stones being absent towards its northern extremity; although there is apparent evidence of their former continuity, in one which remains erect and in others which have fallen from their places. I could not discover any traces of a line parallel to this on the western side; but as some inclosures have been made in the immediate vicinity, it is possible that such might have originally existed; notwithstanding the superstitious reverence with which the Scots in general regard these remains, and the care with which, in their agricultural operations, they commonly avoid committing any injury to them. The intervals between the stones vary from two to ten feet or more, but it is probable that the larger spaces have resulted from the falling of the less firmly rooted pillars which occupied those places. The number of stones in the circle is thirteen, independently of the central one; and the number in the whole building, either erect or recently fallen, is forty-seven.

The aspect of this work is very striking, as it occupies the highest situation on a gentle swelling eminence of moor land; there being no object, not even a rock or stone, to divert the attention and diminish the impression which it makes. The circles found in the vicinity are less perfect, and present no linear appendages: their average diameter varies from forty to fifty feet, and one of them contains four uprights placed in a quadrangular form within its area. I may add to this general account, that solitary stones, apparently of a monumental nature, are found in this neighbourhood, as well as in the island of Bernera and in other parts of Lewis.

The cruciform shape of the structure described above is a remarkable, and I believe a solitary circumstance. It has not at least been noticed among the numerous descriptions of these erections which antiquaries have given to the public. It is true, that in some of the cromlechs or smaller monuments, a disposition of the stones resembling that of a cross has sometimes been remarked, but it seems in all these cases to have been the result either of accident or necessity. No monuments in which that form is obviously intended, have been traced higher than the period of the introduction of Christianity; nor was it indeed till a later age, that of Constantine, that the cross became a general object of veneration. From that time its use is common; and it is frequently found applied under a great variety of structures and forms, to numerous objects, civil and military, as well as ecclesiastical. Those cases in which the figure of the cross has been found marked or carved on stones of higher antiquity, which had served either for the purposes of sepulchral memorials or Druidical worship, appear to have resulted from the attempts of the early catholics to convert the supposed monuments of ancient superstition to their own ends; either from economical motives or from feelings of a religious nature. But such attempts cannot be supposed to have given rise to the peculiar figure of the structure here described. The whole is too consistent and too much of one age to admit of such a supposition; while, at the same time, it could not under any circumstances have been applicable to a Christian worship. Its essential part, the circular area, and the number of similar structures found in the vicinity, equally bespeak its ancient origin. It must therefore be concluded that the cruciform shape was given by the original contrivers of the fabric, and it will afford an object of speculation to antiquaries, who, if they are sometimes accused of heaping additional obscurity on the records of antiquity, must also be allowed the frequent merit of eliciting light from darkness. To them I willingly consign all further speculations concerning it.

The remains of one of those singular structures called

Pictish Towers, is found not far from this place, connected with a subterranean passage which is supposed by the natives to reach the sea. To trace the date, or the authors, of these buildings, appears a hopeless attempt, as no analogous works appear to exist elsewhere, and neither carvings, monuments, nor inscriptions, have been found attached to them so as to give a probable clue towards the discovery. It is unnecessary here to notice the impropriety of the appellation, but it is not unimportant to remark that they are all limited to the northern division of Scotland. From that situation, it is probable that they were the works of the Northmen, whose colonies possessed those tracts; an opinion confirmed by the northern name Dornadilla, the only local title among them, as far as I have discovered, now existing. The most southern are those in Glen Elg and on the frith of Tain. They are numerous in Sutherland; although, with the exception of Dun Dornadil, these are now all nearly levelled to the ground. In Glen Elg they are sufficiently entire to convey a perfect idea of their structure, for which I may refer to Pennant, in whose work they are accurately represented.

The three in Glen Elg are of the same size or nearly so. Those in Sutherland vary, and in some instances appear to have been of somewhat smaller dimensions, as far as can be judged from their present dilapidated state. It is very difficult to comprehend the design of the architects, since the upper galleries, that lie between the inner and outer wall, are insufficient to admit a man: in some, a child could scarcely creep along. Nor are these galleries provided with external apertures for defence, a circumstance which bespeaks the purpose of that construction in the Galloway towers, and in those keeps, which, like that of Restormel Castle, consist of two concentric walls with an interior space. It is probable that they were merely the strong houses of the chieftains of those days, the internal area being perhaps appropriated to the occasional inclosure of the cattle in cases of alarm or warfare.

Of their relative antiquity to those much more singular buildings, the vitrified works, it is impossible to conjecture.

FRESH water lakes are found among the hollows of the hills, and are scattered over the moory surface of the level land, but they do not form the same characteristic and distinguishing feature as in North and South Uist, and in Benbecula. Compared with the rest of the Long Island, Lewis may be said to possess rivers. These are at least tolerably permanent, but in any other situation they would attract little notice. The largest are at Loch Stornoway, Loch Kenhulavig, and Loch Roig, the last of which is somewhat distinguished by a salmon fishery. The courses of these streams are attended by no alluvia or other appearances deserving of notice in a geological view.

The alluvial land which is to be seen in Lewis is independent of these, and however common a feature, is in this situation remarkable, since it occurs no where else in the whole chain of the Long Isle, with the slight exception already mentioned in North Uist. It appears to owe its origin to distant changes on which we have no other conjectures to offer than such as have been often produced to account for similar alluvia in various parts of the globe. In one respect it presents a difficulty, arising from the insular position of the land which it occupies; but even that difficulty is far from solitary, since similar alluvia have been observed in insular situations, and examples of them are described in other parts of this work. If, here as elsewhere, it is fruitless to inquire into the causes of these accumulations, it is no less difficult to conjecture what the circumstances were which limited the deposits to the northern extremity of this long chain. This alluvial matter consists of clay and of clay-marle, together with a mixture of rolled stones of different kinds; but always, I believe, of quartz, felspar, and the several varieties of gneiss. Thus they seem at least to derive their origin from the waste of mountains of gneiss. But they do not lie in the vicinity of the mountainous district, being, on the contrary, visible only towards the north end of the island, where their broken and mouldering edges may be traced and measured on the shores. At Ness, Dale, and Leanol, they are from fifty to seventy feet or upwards in thickness; and repose, where their contact can be observed, immediately on the gneiss which forms the substratum of almost the whole country; the rock immediately subjacent being generally in a rotten and mouldering state.

With one or two exceptions, there is little to be remarked respecting the rocks that constitute this island, which has not already come before the reader. Gneiss is the predominant and fundamental rock; and I shall briefly notice such circumstances with regard to it as have not occurred on former occasions, or have occurred in a form less distinct. Every thing is worthy of attention which conduces to the due knowledge of any one rock; since it is only by comparing the several forms, accidents, and connexions under which it is displayed, that a thorough knowledge of its natural history can be obtained; a knowledge which, extended to all the objects in this tribe of substances, constitutes that science of which we are in search.

The cliffs in various parts of the coast, at the Gallan Head, in the great Bernera, near Loch Carlowa, at the Butt and from it to Tolsta Head, and again from Stornoway to Loch Brolum, offer innumerable examples of the passage of granite veins and of the contortions of the gneiss. I have delineated a few, partly on account of their singularity, partly because they serve to show the changes which the rock must have undergone, and because they illustrate practically that irregularity in the apparent position of the beds at the surface* which I have in the next article attempted to explain by a diagram founded on theoretical views.†

Among the very remarkable appearances displayed by the gneiss is the following, of which two examples occurred, one on Bernera isle, the other near Loch Kenhulavig. In both these a sudden and complete change in the direction of the laminæ takes place, the one set abutting against the other without any apparent intermedium. In one the position is at right angles, in the other oblique.* Such an union may be supposed to have taken place at the same period when the other dislocations and contortions were produced, the disjoined parts being capable of reuniting while in a softened state.

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* Pl. xii. fig. 6.

† The first is selected to show a remarkable circumstance of frequent occurrence,‡ namely, the prolongation and compression of the beds; an appearance tending perhaps more strongly than any other of the numerous irregularities which it presents, to prove the soft and ductile state in which this rock has existed. It is to be observed on the island of Great Bernera. The next example is also to be seen in the same island, which offers innumerable contortions of the most fantastical nature; and it almost equally with the former proves the once flexible state of this rock. The third is calculated to show that intricate position of the laminæ, with those wavings and deviations, which produce, when only examined at the surface, the apparent irregularity in the position of beds of gneiss, a circumstance to which the diagram above mentioned refers. The present is from one of the shores of Loch Bernera. The fourth is at the Butt of the Lewis, the rock which contains it having the aspect of a piece of marbled paper and being above fifty feet in height. It is principally remarkable for the excess of the contortion. On these representations I must remark, that they are drawn as if on a plane surface, to render those bendings and lines which are perfectly visible in Nature equally so in the drawing. The hollows, asperities, and projecting fragments, do not prevent that from being quite distinct in the rock itself, which would be obscured in the drawing by the lines and shadows necessary to express these adventitious circumstances. The interlamination of the dark varieties which contain much hornblende with those which contain little or none, are the lines by which the contortion is rendered visible in the rocks, and the sketches represent the same by the alternations of black and white. The last of these flexures here delineated is to be seen in the cliffs near Loch Hourn on the eastern side, although similar examples occur in various places. Imagination indeed can scarcely conceive an intricacy of this nature of which a resemblance could not be found in Lewis, which far surpasses all the other islands already described in the variety and distinctness of these phenomena.

‡ Pl. xii. fig. 1, 2, 3, 4, 5.

A fact somewhat similar, perhaps identical, is described by Saussure as having occurred to him on the glacier of Miage. He calls the rock a granitel of schorl and felspar, but offers no conjecture respecting it. Considering the state of mineralogical nomenclature when he wrote, it is not improbable that his granitel was a gneiss resembling this.

I have on different occasions described rocks occurring in the gneiss, of a character distinct from it, such as micaceous schist, talc schist, graywacké, and clay slate. At Loch Carlowa a similar circumstance is seen, the rock, which is of a very peculiar appearance, consisting of dark blue quartz interlaminated with black mica. A more remarkable example of the anomalous varieties of gneiss may be observed towards Oreby on different parts of the shore, where it forms an extensive range of rocks. It consists of an orange red felspar, with a harsh granular fracture proceeding apparently from an intermixture of quartz, containing distinct scales of an argillaceous schist mixed through it in a very regular manner and in a laminar direction. In the same place green compact felspar, similar to that of Iona, is found in great abundance, forming distinct beds in the gneiss, or dispersed through it in thin plates and prolonged fibres.

Not far from this place may be seen one of the most interesting varieties which occurred in the course of this investigation. It consists of the most usual intermixture of dark and pale gneiss in pretty equal and parallel laminæ, the darker parts abounding in hornblende, the lighter in felspar. Dispersed through this rock are crystalline concretions of felspar, thickly disseminated, and disposed in a laminar direction corresponding with the general structure of the rock. This felspar is splendent or nearly glassy, and the concretions, although highly crystalline within, have no external configuration. They are seldom less than a quarter of an inch in diameter, and attain to that of three inches. It is not unusual to meet with crystallized felspar in gneiss, and the appearances which it exhibits are often remarkable, as the laminæ are generally bent and accommodated to the shape of the crystal. But it rarely in these cases exceeds the fourth of an inch, and seldom possesses that perfectly crystalline aspect which it here displays. This rock is also bent, like most others in the island, and is attended by an accidental circumstance which renders the incurvation particularly striking. This is the falling away of the surrounding parts, which have thus left standing an example, perhaps solitary, of a bent and detached rock. It is about thirty or forty feet high.*

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* Pl. xxxi. fig. 3.

In the neighbourhood of Stornoway, and in the interior country towards Tongue and Barvas, the gneiss is found passing into common argillaceous schist; forming a compound rock, in its constituents not unlike that which has been described under the head of North Uist, but much less hard in texture. To describe it correctly, it may be said that a felspar much intermixed with quartz forms the one part, and common clay schist the other. Sometimes the first substance predominates, at others the last, and as these vary, so the rock passes on the one hand into a gneiss, on the other into common clay slate. It differs from the compound rock of North Uist in being much less hard, the schist indeed generally retaining its ordinary degree of softness and its fissile disposition. I need not repeat the general remarks formerly made on this transition; the recurrence of other similar instances serves to prove that it is an appearance of no accidental nature or limited extent.*

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* Plate I.

This rock occupies a very considerable tract in Lewis, occurring on various parts of the coast from Stornoway southwards. Were it possible to have access to the inland rocks in this quarter, there is little doubt that it would be found to extend very far within the country, here as well as at Stornoway. From Loch Shell to Loch Brolum it forms the whole range of cliffs, being mixed in an irregular manner with the common gneiss, and traversed, as that is, by granite veins. It is much contorted and displaced, being also broken into arches and hollowed into caves, the higher pinnacles being the resort of the eagles with which this shore abounds. At Loch Brolum this mixed rock is gradually succeeded by a simple argillaceous schist, the gneiss being at length totally excluded. It here contains green compact felspar, and resembles precisely that soft schist which occurs at the entrance of Loch Maddy. Beyond this point I observed it no longer, the gneiss in its most common forms returning at Loch Valumis and continuing to the entrance of Loch Seaforth, where the coast line of the Lewis terminates.

I observed but few of those minor beds of the rocks which are of general occurrence in gneiss, and of which examples have been described in the other islands before examined. A body of limestone occurs at Gres, near the junction of the gneiss with the conglomerate to be hereafter described. It is however not easily examined, and it will probably be found to appertain to the red sandstone, since it is known to form partial deposits in similar situations elsewhere. I may add that there are two caves containing calcareous stalactites, one near the same point, and the other near Tolsta Head, both of these probably resulting from the vicinity of similar masses of calcareous matter. At Loch Valumis there is also a rock of serpentine containing fine specimens of asbestos, which circumstances did not allow me to investigate accurately.

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* Since the period at which this was written I have often met with argillaceous schist connected in the same manner with gneiss, and occupying tracts of various extent. It occurs thus in Sutherland, in Ross-shire, and elsewhere on the western coast of the mainland.—1818.

The next rock to be described is a conglomerate which is found at Stornoway, forming the point of Arnish and a small island in the harbour, and extending along the eastern shore to a point beyond Gres, where it terminates in the gneiss. It also forms a portion of the Aird, reaching as far as Garbust on the northern, and the Chicken Head on the southern shore. It here presents perpendicular and very even cliffs, composed of strata inclined at an angle of about thirty degrees.* It is composed of rolled pebbles of different sizes, reaching to the diameter of a foot or more, and imbedded in a coarse compacted gravel of the same materials; but occasionally it passes into a finer sandstone. These materials are fragments of quartz, of felspar, and of different varieties of gneiss.

In its aspect this conglomerate bears a perfect resemblance to most parts of that great range which is found on the main land of Scotland separating the primary from the secondary strata, but it is in general of a much harder texture. It reposes immediately on the gneiss, and the junction may be seen with great ease between Swordil and the Chicken Head, where it is perfectly laid bare by the exposure of the cliffs. The gneiss is here intersected by granite veins and much disturbed; in consequence of which, great irregularity occurs in the position, and great inequality in the terminating surfaces and ends of the beds. All these inequalities appear as if filled by the conglomerate; which seems to repose on them, occupying all their cavities and assuming the regularly stratified form as soon as it has accumulated beyond these.

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* Caves of various dimensions are found in these cliffs, offering subjects of considerable beauty to the pencil of the artist.

So little of this rock is however here to be seen that it is impossible to decide on the real nature of this connexion. It would be concluded, from its general character, to be analogous to the old red sandstone, and therefore, like the rock with which I have compared it, to be the first of the secondary strata. Yet this opinion is subject to serious doubts. I shall hereafter, in describing the Sandstone islands, have occasion to show, that a red sandstone occurs, not only in these, but on the western side of the adjoining continent, forming a member of the primary rocks. It is probable that the conglomerate of this island is analogous to it, or a portion of the same great deposit; but as the reasons for this opinion could not be appreciated without anticipation, I shall refer the reader to that part of the history of these islands, when he will be enabled without further assistance to form his own judgment on the subject.

I have reserved for the last place the description of one solitary and anomalous instance of a conglomerate, because its disjointed nature would not admit of its entering into the description of either of the preceding rocks. It is to be seen at Loch Carlowa, where it forms a single bed of no great thickness, reposing immediately on the gneiss, and apparently alternating with that rock. It is elevated at an angle of 45 degrees, and is about 70 or 80 feet in height and 50 in breadth, the flat surface being exposed. The gneiss on which it lies and by which it is surrounded, is violently contorted and contains an unusual proportion of granite veins; this confusion forming a striking contrast to its own undisturbed appearance. That it is actually contained between two portions of gneiss, seems proved from its being accompanied by a vein of quartz passing in the same undisturbed direction both through it and the troubled mass of rock in which it lies. It is composed of slightly rounded or angular pebbles of quartz and gneiss imbedded in a gravelly clay. The neighbourhood no where produces any similar rock, the large tract of conglomerate already described lying on the opposite side of the island. The nature of this substance is obscure. It is not likely to be either a solitary spot of a secondary formation deposited as it now lies, or the remains of a larger mass of such strata; and it can scarcely, from its regular position compared with the irregularity of the surrounding gneiss, be a portion of those beds, or a real alternation. It may possibly have originated in a fissure which has been filled by an accumulation of rolled matter, and subsequently laid bare on one side by the falling of the boundary. In this case it will afford an example of a circumstance of considerable rarity, a conglomerated vein. The quartz vein which crosses it may be of more recent origin.

It is almost superfluous to say that trap veins occur in this as in all the other islands. They are not however numerous, nor did I observe any sufficiently remarkable to deserve particular description.

Sulphate of Barytes is found in the conglomerate near the Chicken Head, but not in great quantity; nor does it present any regular crystallizations.

These remarks terminate the description of the Long Isle; a tract rendered wearisome by the incessant recurrence of the same rock and the almost total want of variety which its survey affords. The paths of this science, like the subjects of which it treats, are not fertile in flowers, and the gneiss of these islands, exposing bare rocks without marks of vegetation or varied only by the brown moor and quaking bog, is an emblem not unapt of the sterility with which the pursuit too often repays the labour and the patience of the geologist.

THE FLANNAN ISLES.*

These islands are seven in number and lie seventeen miles to the north-west of the Gallan Head in Lewis, to which estate they belong. The largest appears to contain about 80 acres, the second perhaps 20, and the rest are of much smaller dimensions. The two first are fully stocked with sheep, although the traveller who has found some difficulty in climbing to the surface, may be at a loss to conjecture by what means they are carried up the cliffs or removed. The smaller are unoccupied, a circumstance rare in the Highlands, and arising here, only from their inconvenient situation. The annual rent of the whole is £10, a price paid rather for the birds by which they are inhabited than for the grass they produce. Various sea fowl of the species usually found in these seas have here established their colonies, but the most numerous is the puffin. These literally cover the ground, so that when on the arrival of a boat they all come out of their holes, the green surface of the island appears like a meadow thickly enamelled with daisies. The soil is so perforated by these burrows that it is scarcely possible to take a step on solid ground. On any alarm, a concert of a most extraordinary nature commences. Those who have not frequented similar coasts will perhaps smile when the effect produced by the united cries of the various sea fowl, is called harmonious. Separately considered, the individuals cannot be esteemed peculiarly melodious, yet the total effect is no less pleasing than extraordinary; and may not unaptly be compared to the ancient ecclesiastical compositions which abound in a perpetual recurrence of fugue and imitation on a few simple notes. It requires no effort of imagination to trace the sound of the flute, the hautboy, and the bassoon, in the cries of the several birds; the upper parts being maintained by the terns and the gulls, the tenors by the auk tribe, while the basses are occasionally sounded by the cormorants. The cultivated musician will, independently of the general effect, derive pleasure from the perpetual repetition and the apparently perfect resolution of the discords; while the whole is varied by the pauses which are occasionally interposed, and by the swelling of the sounds on the breeze; or by their alternate increase and diminution as the alarm subsides and is again renewed.

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* Flann, Gaelic, red, or blood; possibly from the reddish colour of the cliffs of gneiss. It was also the name of some Irish chieftains. See the general Map.

These islands are bounded all round by cliffs cut sharply down to the sea, and almost all bearing the marks of recent fracture and separation; an appearance arising from the little wearing which they undergo from atmospheric action, and from the obstinacy with which they seem to resist the growth of lichens. They afford, in consequence, rocky scenery of considerable grandeur; the effect being enhanced by the very circumstance now noticed, the marks of force still strongly impressed on them, as if the moment of their separation and ruin were but just passed before the spectator's eyes. Their average height appears to be about 100 feet.

As they do not seem to have been surveyed, they are an object of terror to mariners intending to pass round the Butt of the Lewis, their situation only being marked in the sea-charts. That terror is misplaced. Two detached rocks only, lie to the westward, but they are both visible at high water, and with this exception, a ship may range them safely at half a cable's length; since they are free from sunk rocks and the water is of great depth.

The Flannan isles are all composed of gneiss, traversed by numerous granite veins of different sizes and ramified in all directions. Although the various cliffs of the Long Island might be expected to show the disposition of the rocks perfectly, some obscurity every where attends them; from the lodgment of plants, the growth of lichens, or other causes. Here, every thing appears as if it had been cut and polished by a lapidary; and the consequence is, the most accurate and minute detail of every contortion, bending, or displacement of the gneiss; with a view of the minutest ramification of the granite veins, and of the disturbances which are communicated by them to the main body of the rock. Those who have only examined gneiss in the small portions in which it is commonly accessible in mountains, and where, in general, little but the surfaces of the beds are visible, will here perceive the causes from which the confusion so common in this rock arises.* They will also have little difficulty in tracing it to the granite veins; to the magnitude, position, and ramification of which, the distortions of the gneiss will always be found proportioned.

These veins exhibit considerable varieties of composition. Occasionally they are of a most minute grain, often indeed so compacted as to resemble some varieties of trap; in some places they have the aspect of an ordinary massive granite, while in others they are formed of large concretions, the most frequent character of the granite veins which occur in the gneiss of this country. Beautiful specimens of nacreous white felspar of great magnitude are found among them, often accompanied by similarly large crystals of black mica. In one place a vein of a complicated structure occurs, the middle lamina being pure quartz terminating at each side in a fine grained granite. The graphic variety also is here to be seen.

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* A diagram which consists of a curved line cut by two parallel straight lines (Pl. XII. fig. 6.) will explain this appearance, the waving line representing the bending of the beds of gneiss, and the straight included portion that which is accessible at the surface. That portion which lies above the uppermost line must be conceived absent, as that which is below the lowermost is invisible.

While the difficulty of tracing the position of gneiss on the surface has frequently caused geologists to entertain doubts respecting its stratification, it has equally led to misconceptions on the nature of its connexion with the granite veins; if indeed some of the received opinions on this subject have not rather been of a hypothetical nature than founded on real observation. These veins have been supposed integrant and original portions of the gneiss, or of contemporaneous formation, and they have also been said to originate and terminate in the gneiss. It is easy to see that such misconceptions respecting the stratification of this rock would follow from those partial views which the diagram above given is meant to illustrate. Here there are no independent parts, but it is quite easy in imagination so to dispose of the several portions of rock as to give that irregular and discontinuous appearance which is generally seen in partial examinations of the surface.

In these islands the regular prolongation, continuity, and ramification of the veins, is also perfectly apparent; and the eye traces them with the same facility as it does the contortions of the gneiss. Another fact is here visible which is also of importance in the history of these veins. This is their distinctness from the rock which they traverse. Most observers have, I believe, imagined an intimate connexion, or amalgation, to exist between the veins and the rock; a deception arising from similarity of ingredients, and from that equable hardness which causes both to yield in the same degree to the hammer. The sea has here served to detect that which the hammer can not. Wherever it has had access (and its spray reaches almost every where) the vein is perfectly distinguished from the rock; and whatever its texture may be, it is separated without difficulty, often falling out for a small space and leaving a furrow imprinted to mark its former situation. I may conclude by remarking, that the granite veins of the Flannan isles display precisely the same evidence of their posteriority to the gneiss as is presented in the case of limestone or schist by the similar veins that traverse these rocks. The trap veins which pass indiscriminately through every substance that lies in their way do not furnish stronger proofs of an origin more recent than that of the including strata.

The gneiss of these islands is in general composed of quartz, felspar, and mica; the latter ingredient, which is rare in the Long Island, being here abundant. It presents, as usual, many varieties, and among the rest there is one which cannot be distinguished from common granite. This consists of an equal mixture of flesh coloured felspar and quartz, with but little mica. It forms beds among the rest of the rock; but as they lie in the most precipitous and highest part of the cliff their dimensions could not be ascertained: some loose blocks measured three feet in thickness. There is not a trace of the laminar tendency in their structure, and therefore, although they may be considered as forming portions of the gneiss beds, they present, in strictness, an example of bedded granite. Similar examples have been already noticed on various preceding occasions, but none before these exceeding a few inches in thickness; and all appearing to be parallel veins. The circumstance is in this view important, as it may throw light on the much disputed question of stratified granite. If granitic portions of gneiss beds can vary in dimensions from inches to feet, there appears no reason why they should not attain a much greater size. Such rocks would be termed stratified granite, if the circumstances under which they appeared were such as to prevent a sight of their real connexions. The limits which separate granite from gneiss are indeed already sufficiently evanescent, and of this perpetual gradation, scarcely a mile of this survey does not offer an example. Yet the geological distinctions of the two are, when considered under all their appearances, strikingly marked; nor is it justifiable to draw conclusions respecting a part of geological science so important as the history of granite, from a few partial appearances which may admit of another explanation. The satisfaction derived from the investigation of truth ought to be superior to the triumph derived from affording temporary support to a favourite theory.

SULISKER.[*] NORTH RONA.

These islands, although at a considerable distance from each other, are usually associated by the joint appellation of Barra and Rona, but they are scarcely known except to the mariners who navigate the north sea and to the inhabitants of Lewis, of which estate they form a part. They are the northernmost of the Western islands, the Thulé of the other islanders, who consider them as placed "far from the sun and summer gale," and beyond the limits of the habitable world. To have visited Barra and Rona gives a claim to distinction scarcely less in their estimation than to have explored the sources of the Nile or the Niger. Their latitude is stated in the common tables at 58° 54′ and 55′, Sulisker being one minute south of Rona; while the longitude of the former is marked 6° 4′ and that of the latter 5° 51′ west. In Arrowsmith's map they are laid down still less correctly in 58° 46′ latitude.[†]

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[*] The sail rock. Suil, a sail. No room could be found for these islands in the map without extending it to an inconvenient length.

[†] There is reason to suspect that these latitudes are materially incorrect; a circumstance interesting to ships navigating the north sea, as they lie in a frequented track, and, from their small size and elevation, may easily escape notice, particularly in hazy weather. My departure was taken from Cape Wrath, and having by the evening run down the course as indicated, no land could be seen. The weather proving thick, it became doubtful whether we should find them, and the vessel was hove to for the night. The day breaking with a bright yellow horizon, Barra was seen bearing north about twelve miles. Having beat up to Rona by mid-day the sun shone out and permitted an observation to be taken, by which I found its latitude to be 59° 10′, being about thirteen miles north of that assigned by the tables. The distance between them as run by the log appeared to be about nine miles. The journals of the Fortunée give the longitude (by account) of Rona at 5° 42′, and of Barra at 6°, and the latitude of the former from a mean of bearings at 59° 9′.

Sulisker (or Barra) appears to be about half a mile in diameter, having a grassy slope towards the north, and presenting to the south a bluff face of 300 feet or more in height. It is inhabited only by sea birds, and principally by gannets, the exposed situation and the difficulty of landing, rendering it inexpedient to keep sheep on it, as is done, with no great profit indeed, in the Flannan isles. During one week in the breeding season it is visited for the sake of the feathers, by the tenant of both the islands, who resides in Lewis.

The sea running high, I found it impossible to land, but approached sufficiently near to discern without difficulty that it was composed of gneiss traversed by veins of grey and of reddish granite. Whatever else it may contain must remain to reward the labour of any future mineralogist who may meet with better weather than that which fell to my lot.

Rona is accessible in one spot only, and even that with difficulty, from the long swell which is rarely altogether absent in this sea. The landing place is only the face of an irregular cliff, and it is necessary to be watchful for the moment to jump out on the first ledge of rock to which the boat is lifted by the wave. The removal of the sheep is a perilous operation, the animal being slung by the legs round the neck of a man and thus carried down the face of a rock where a false step exposes him to the risk of being either strangled or drowned. To find inhabitants on such an island is a strong proof, among many others, of the value of land in this country compared to that of labour. There are few parts of Britain where Rona would not be abandoned to the sea fowls that seem its proper tenants.

The length of this island was estimated at a mile and

I may add that there are some outstanding rocks not laid down in any chart, and, among others, one to the N. W. of Barra at about a mile distance.

a quarter, and its breadth where widest at half a mile, the time not admitting of a more accurate measurement. Its position is nearly east and west, and at the western extremity the rocks run far out into long flat ledges: there is also a similar ledge towards the north partially covered with grass. The remainder of the island is surrounded by high cliffs more or less abrupt, perpendicular at the northern side, and there rising to an elevation of 400 feet or more. Numerous caverns, some of considerable magnitude, are seen in these cliffs; while the contrast between the green foam of the waves that break into them and the pitchy darkness of their deep abysses, united to the grey mist of the driving sky speckled with the bright wings of innumerable sea fowl, produces effects fitted for the pencil of Turner and of him alone. The violence and height of the mountainous seas which in winter break on this island are almost incredible. The dykes of the sheep folds are often thrown down, and stones of enormous bulk removed from their places, at elevations reaching to 200 feet above the high water mark; so powerful is the breach of the sea. Thus the land is in a state of constant diminution at the western end, and the soil is here washed away for a considerable space. The island lies with a general declivity towards the south and presents an even swelling surface covered with verdure. The highest point is near the eastern extremity and does not seem to exceed 600 feet. To sit on this spot, whence no trace of human existence is visible, and to contemplate from such narrow bounds the expanse of water every where meeting the sky, produces a feeling of solitude and abandonment like that of the deserted mariner on a distant rock. The ship on the ocean is a world in itself. There, even if alone, we seem to move towards the society we have left, but Rona is for ever fixed in the solitary sea.

Some years have now past since this island was inhabited by several families, who contrived to subsist by uniting fishing to the produce of the soil. In attempting to land on a stormy day, all the men were lost by the upsetting of their boat, since which time it has been in the possession of a principal tenant in Lewis. It is now inhabited by one family only, consisting of six individuals, of which the female patriarch has been forty years on the island. The occupant of the farm is a cottar, cultivating it and tending fifty sheep for his employer, to whom he is bound for eight years; an unnecessary precaution, since the nine chains of the Styx could afford no greater security than the sea that surrounds him, as he is not permitted to keep a boat. During a residence, now of seven years, he had, with the exception of a visit from the boat of the Fortunée,* seen no face but that of his employer and his own family. Twice in the year, that part of the crop which is not consumed on the farm, together with the produce of the sheep and the feathers obtained from the sea fowl which he is bound to procure, are taken away by the boat from Lewis, and thus his communication with the external world is maintained. Fortunately he seemed to care but little for any thing out of the limits of his own narrow kingdom.† In addition to the grain and potatoes required for the use of his family, he is allowed one cow, and receives for wages the value of two pounds sterling annually in the form of clothes. With this, the family, consisting of six individuals, must contrive to clothe themselves; how they are clothed it is scarcely necessary to say; covered they are not, nor did there appear to be a blanket in the house; the only substitute for a bed being an excavation in the wall, strewed, as it seemed, with ashes and straw. Besides the produce of the farm they are supplied with animal food, in the sea fowl and in the small coal fish (cuddies) which are taken with the rod; and thus, with all their disadvantages, are sure of abundant food, that with which their countrymen in the situation of small tenants are not always provided. At such a price is here valued the labour of three individuals, for which the farm finds full employment.

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* Then employed in cruising after the President in 1812.

† On the appearance of our boat the women and children were seen running away to the cliffs to hide themselves, loaded with the very little moveable property they possessed, while the man and his son were employed in driving away the sheep. We might have imagined ourselves landing in an island of the Pacific Ocean. A few words of Gaelic soon recalled the latter, but it was some time before the females came from their retreat, very unlike in look to the inhabitants of a civilized world.

The soil is of a good quality, and produces barley oats and potatoes. The average surplus of corn remaining beyond the consumption of the family was stated at eight bolls of barley; and this, united to the produce of the sheep, and an annual supply of eight stone of feathers, is, to the tenant, the value of North Rona. To him, who is one of the tacksmen of Lewis, the land is let for two pounds a year.

There is no other water in the island than that which is collected in pools from the rain, but there is no chance of any deficiency in this article. As there is no peat, turf is used for fuel and the oil of the cuddy for light; but, with characteristic improvidence, there are no means of lighting the fire should it ever be extinguished. Well may the vestals of this cottage watch the smoky embers and trim the dying lamp.

Such is the violence of the wind in this region that not even the solid mass of a Highland hut can resist it. The house is therefore excavated in the earth, the wall required for the support of the roof scarcely rising two feet above the surface. The roof itself is but little raised above the level, and is covered with a great weight of turf, above which is the thatch; the whole being surrounded with turf stacks to ward off the gales. The entrance to this subterranean retreat is through a long, dark, narrow and tortuous passage like the gallery of a mine, commencing by an aperture not three feet high and very difficult to find. With little trouble it might be effectually concealed; nor, were the fire suppressed, could the existence of a house be suspected, the whole having the appearance of a collection of turf stacks and dunghils. Although our conference had lasted some time, none of the party discovered that it was held on the top of the house. It seemed to have been constructed for concealment from white bears or men more savage still, with a precaution, now at least useless. The interior strongly resembles that of a Kamschatkan hut; receiving no other light than that from the smoke hole, being covered with ashes, festooned with strings of dried fish, filled with smoke, and having scarcely an article of furniture. Such is life in North Rona; and though the women and children were half naked, the mother old, and the wife deaf, they appeared to be contented, well fed, and little concerned about what the rest of the world was doing. It was still an object of curiosity to ascertain if beings so insulated had no desires to return to society and mingle once more with their fellow creatures. But though man is gregarious, the want of extended society is in a great measure the want of cultivated minds. Here the family was society enough, and to provide for the demands of the impending day, sufficient occupation. The inferior members of it seemed to know of no other world than North Rona, and the chief appeared to wish for little that North Rona could not supply. The only desire that could be discovered after much inquiry, was that of getting his two younger children christened, and for this purpose he had resolved to visit Lewis when his period of residence was expired. I need not say to those who know the Highlanders, that their sense of religion is not limited to externals. Amid his solitude this poor man had not forgotten his duties, though excluded from the advantages of their social forms. Yet I shall not be surprised if after the accomplishment of his only wish he should again long for his now habitual home: and expect that some future visitor will twenty years hence find Kenneth Mac Cagie wearing out his life in the subterranean retreat of his better days.

Like Sulisker, Rona consists of gneiss, alternating with beds of hornblende schist equalling or exceeding it in quantity, and traversed by granite veins. The gneiss is of the granitic character, resembling that of Lewis, and the hornblende schist is distinguished by the great profusion of garnets it contains. These are so abundant that the weathered rock sometimes presents an uniform red surface, the hornblende wasting away, while the more durable garnet continues protuberant above it. They are occasionally of a large size, attaining the diameter of an inch or more, and occupying also the veins of granite and of quartz which traverse the beds. In this case they are occasionally transparent, but always too much fissured to admit of being rendered ornamental by polishing.

The most conspicuous of the granite veins is many yards in diameter, and extends from the landing place to the north side of the island, in a straight course nearly north and south. It is remarkable for the magnitude and beauty of the felspar it contains, and of which it affords specimens of much interest to collectors. This is of a salmon colour and pearly lustre, translucent, and reflecting much light from the interior laminæ. Sometimes it is so intermixed with quartz as to form graphic granite of various aspects, and occasionally, as in East Rona, of a laminar structure. The quartz of this vein is also remarkable for the variety which it presents. It is sometimes grey and opaque, at others smoky brown and transparent, or white and opaque, or perfectly transparent and colourless. Besides these, there occur large concretions of opalescent quartz, varying from a highly diluted to a more perfect milkiness, and occasionally tinged with blue, in which case the specimens possess considerable beauty. In other veins there are found concretions of felspar equally large and beautiful, of a French grey colour, accompanied by quartz of a similar tint, and, like the former, these are occasionally mixed in a graphic manner.

It is not improbable that a more rigid search might add something, to the varieties at least, of these substances; but the rising of the wind and sea rendered a precipitate retreat necessary. The addition of a few specimens to the catalogue would have been dearly purchased by even a week's residence in the stormy and solitary abode of North Rona.

RONA.[*] (EAST.)

After the repeated and wearisome descriptions of islands of gneiss, scarcely any thing remains to give interest to the account of Rona, the geographical importance of which is however too great to allow it to pass without notice. At the same time its connexion with Rasay gives it a claim on attention, since it becomes the connecting link between the division now under review and the group of the Trap islands which is about to follow.

Its aspect at a distance is little engaging, even to a geologist; to whom its external configuration presents no promise of variety; while the evident indications of gneiss offer still less temptation to him who has already toiled through the uniformity of the Long Island. To an ordinary traveller it is even repulsive, presenting no picturesque features and but little verdure to checker or contrast with its grey and sterile surface; the very patches of brown mountain pasture it possesses being almost lost to the eye amid the rocks which rise on all sides.

Rona is five miles in length and less than one in breadth, forming a long parallel ridge prolonged from the northern part of Rasay, and geologically connected with it by the intermediate island Maltey and some smaller rocky islets scattered in the sound by which they are divided. The greatest elevation does not seem any where to exceed 500 feet, the whole ridge being separated by deep irregular valleys into rocky hills much resembling in their general characters those of Coll.

In proportion to its area it is among the most barren and unproductive spots in the Western islands; containing a very scanty proportion of arable ground, and being chiefly appropriated to the rearing of black cattle. Four small harbours are found on the west side, one of which, Archasig hirm, offers a convenient refuge for coasting vessels, with a double entrance; but it is very little known except to the natives and the neighbouring islanders. It is very imperfectly laid down in Mackenzie's chart, nor does it appear to have been surveyed by himself. For this reason and because it is the only station from which Rona can conveniently be examined, it may be proper to add a few words respecting this anchorage. The entrance is covered by a rocky islet by which the harbour is completely land-locked, so that vessels may ride securely in any wind and weather, as in a mill-pond, and in good holding ground. The passages are both narrow and beset with rocks, but as these are all visible at half tide, it is easy to steer safely through them: the southern one is most free. It is easily known, in running down the shore, by the mouth of a cave visible on the island before described. When to those advantages it is added that fresh provisions and water may be procured here, I may be suspected of imitating the narratives of the voyagers who have navigated the South seas; but those who know the country in question will be well aware of the practical value of this remark.

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[*] See the Map of Sky and also the general Map.

THERE is so much irregularity in the positions of the gneiss that it is impossible to give any general account of them, nor is any advantage to be gained by detailing the numerous changes they undergo. On the eastern side there will sometimes be found a great sequence of very straight beds dipping uniformly towards the east, while on the western they lie in a contrary direction; the two meeting in the middle of the island like the roof of a house. In other places the same beds will be found reversed, the eastern beds dipping to the west, and vice versâ; or they undergo changes still more intricate, displaying those wavings and contortions of which so many examples have already been recorded. These rocks are as usual traversed by granite veins, which, as in Coll and elsewhere, frequently present the graphic character; and they alternate with simple hornblende schist, or with that variety in which felspar forms an ingredient. The granite veins appear so much blended with the rock that it is often difficult to trace the line of separation. In one or two instances the graphic granite presents a peculiarity of structure already noticed in North Rona, consisting of alternate laminæ of quartz and felspar; the former being occasionally diminished after a certain space, so as to disappear in a thin edge.

The varieties of this gneiss are so numerous as not to admit of description, but it may be remarked, that like that of the Long Island, it generally possesses the granitic character, being large grained; differing however in containing mica where that contains hornblende: the quartz and felspar are nevertheless predominant, and are often indeed the only substances entering into its composition. Like the gneiss of Tirey, Iona, and Harris, it frequently contains green compact felspar ramifying in different directions with much minuteness of subdivision. It is also conspicuous in many places for the great proportion of quartz it contains, this mineral possessing the chalcedonic aspect so common in gneiss. In some instances the rocks are entirely formed of alternating layers of this substance with felspar, with mica, or with hornblende schist, exhibiting specimens of considerable singularity. It may be further remarked that the felspar is generally red, and that the predominance of this colour gives a peculiar appearance to all the rocks of the island.

The felspar found in the veins, like that already described in the Long Island, is often in large concretions, which are always connected with the graphic mixture of quartz and felspar before mentioned. It is of a brownish-red colour and glassy lustre, and is intersected by opaque threads; a circumstance common in this variety of felspar.

The quartz, independently of the aspect above mentioned, is often also remarkable for a green colour, which is generally dull, and appears to arise from fibres and laminæ of the green felspar. It occasionally also contains mica, as well as hornblende; while, being of a nearly crystalline transparency, it transmits their colours, acquiring thus a fallacious hue of green or black. In similar circumstances it often appears of a brick red from an intimate mixture of felspar. Coloured quartz of the usual character is also found in different places, and most abundantly on the skirts of the hills near Archasig vore. It varies from pink to dark reddish purple, the latter adding a variety of no very common occurrence to those already described on former occasions.

In the natural cavities of the hornblende schist that mineral is sometimes found crystallized, but in the specimens which I procured the prisms were without regular summits.

I have only to add that tetraedral grouped crystals of oxidulous iron are not unfrequent in the granite veins.

CONCLUDING REMARKS ON THE GNEISS ISLANDS.

Although the tracts thus described comprise the chief masses of gneiss which occur in the Western Isles they do not include the whole, as will appear in the account of those islands which are to follow. The complicated structure of these rendered it proper to arrange them in a separate division. But in considering those portions which consist of gneiss, there appear no circumstances requiring such notice as to render it necessary to defer this general comparison.

From the dispersed nature of the preceding remarks on this rock it will be useful to bring the whole of its leading characters into one general view: a proceeding the more necessary as they appear never to have been clearly defined. It is not however in this view pretended to give a complete history of gneiss, since the remarks are only deduced from investigations limited to Scotland. They will still serve as contributions towards a more perfect one at some future period.

The great, or picturesque features of gneiss present every possible variety. It often exhibits a dead level for a considerable space; as in Tirey, Benbecula, and other islands above described; the only access obtained to the naked rock being from some pool of water or accidental breach of the surface. Occasionally, as in Lewis, protuberant masses are seen breaking through the soil. These become in other situations, as in Coll and Rona, so numerous, that, on a general view, nothing but a continuous extent of rock can be seen; the small quantity of herbage, with the occasional lakes that occupy the intermediate spaces, being only visible in the immediate vicinity of the spectator. These rocky hills rarely exceed an hundred feet in height. In the northern and central parts of Scotland, the prevailing features of the country are, like those of Cornwall, undulating; and the gneiss is generally covered with wet moory soil or with peat. These undulations gradually increase in height, assuming the mountainous character and displaying broken faces of rock. In further progress they produce a craggy and abrupt outline; while the mountains on the western coast attain an elevation equalling the general average of those throughout the country. Loch Hourn is particularly distinguished by the height and ruggedness of the hills that surround it; among which the district of Knoydart is pre-eminent, forming indeed the wildest tract in all Scotland.

It will be immediately seen, that there are two principal varieties of gneiss; the one of a granitic and the other of a schistose structure. From the latter a soil is formed, and general features produced, scarcely differing from those which occur where micaceous schist is the substratum. The former is remarkable for its indestructibility, and hence arises the peculiar nakedness of the countries that are composed of it. Considering its near resemblance to granite, a rock not often remarkable for braving the effects of time and weather, the causes of this power of resistance are not obvious: to a certain extent they may consist in the absence of fissures, denying access to frost. To this latter circumstance is owing the want of springs, so conspicuous throughout the Long Island; and the same consideration explains the deficiency of recent alluvia, so general in the islands of this group.*

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* A striking instance of the differences of soil resulting from this distinction occurs at Strontian and in the adjoining land of Morven; the common boundary that separates the gneiss and granite being rendered visible at a distance by the transition from a brown and heathy to a green and grassy covering: the latter, I need scarcely say, lies on the granite.

The stratified disposition of gneiss, and its conformity to the general bearing of the Scottish strata, have already been noticed. The causes of the obscurity which occasionally attends it must also have been apparent; but it may be added that this obscurity is almost peculiar to the granitic variety, and that the schistose is generally disposed with as great a degree of regularity as the analogous rocks, micaceous schist, quartz rock, and clay slate. It is scarcely necessary to repeat, that every possible variation of dip is combined with this uncertainty of direction. The flexures present an endless variety, and, like the other irregularities, are almost limited to the granitic division. They have been fully described where they occurred.

All the varieties of gneiss are occasionally intersected by granite veins, and they are indeed almost characteristic of this rock; being rarely absent for any considerable space, and seldom traversing micaceous schist unless under circumstances where they can be traced to some neighbouring mass of granite. They are however most abundant in the granitic division. They are infinitely various in size and in the number and intricacy of their ramifications; and it is further worthy of remark, that the contortions of any mass of gneiss are always proportioned to the number and importance of those which it contains.* Hence it is that the schistose is more free from contortions than the granitic variety. It is nevertheless proper to make an exception respecting those beds of gneiss which alternate with other rocks, such as clay slate; these, as far as I have observed, never containing veins. In some varieties of gneiss they are so abundant as nearly to exclude the original rock, so that the mass presents little else than a congeries of veins. An instance of this nature occurs in the Flannan isles, but the most striking are to be seen on the north west coast between Loch Laxford and Cape Wrath. The latter spot is no less remarkable for its picturesque grandeur than for the perfect manner in which it displays this circumstance; the cliffs being free from lichens and unaltered by the weather, so that all the parts are as visible as in an artificial section. The hornblende schist and the gneiss are broken into pieces and entangled among the veins in the same manner as the stratified rocks are in the trap of Sky;* but with infinitely greater intricacy, so as rather to resemble a red and white veined marble with imbedded fragments of black. These fragments do not seem to form a twentieth part of the whole mass; while the progress of the different veins, and their effects in producing the disturbance, are as distinct as in an ordinary hand specimen. If the intricacy of the ramifications, and the intersection of one set of veins by a second and a third of different textures, present an argument in favour of a succession of these at several periods, there is here no want of such evidence. I have only to regret that I cannot give a correct view instead of the very slender sketch subjoined: the limits of the plates do not admit of a more perfect representation.†

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* As almost every part of Scotland presents examples to illustrate this remark it is unnecessary to quote the places where they occur. But the gneiss of Strontian offers an instance too important to pass unnoticed. The whole of the surrounding country is formed of beds holding a rectilinear course and presenting an undisturbed stratification, while they contain very few granite veins. But in the vicinity of the granite of that district the veins become numerous, and here the regularity of the gneiss ceases, while it also assumes a character more decidedly granitic.

Whether these granite veins are connected with masses of granite in all cases, can not be determined. In some instances, as in Perthshire where the gneiss reposes on granite, it is probable that they proceed from it; but it has already been seen that there are no traces of that rock in the Long Island. That is however no proof of its non-existence, and the circumstance of the veins being always present when the gneiss reposes on granite, and absent when another rock is interposed, renders it probable that in these cases granite, though invisible, is still present.

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* It is not easy to admit the arguments derived from these appearances in favour of the igneous origin of trap and refuse them in the instance of granite. There is in truth no difference in the cases but that which arises from the difference of the materials engaged.

† Pl. XXXI. fig. 1.

The following considerations render it probable that the granite veins which traverse gneiss are posterior to the including rock, and formed under circumstances analogous to those under which other granite veins have intruded into the schistose rocks with which they interfere.

They are accompanied by fractures or contortions of the gneiss, of such a nature as to prove that it once possessed a condition capable of yielding in different ways to external force, while these appearances are also proportioned to the number and intricacy of the veins. In the schistose varieties which yield easily in the direction of the laminæ, the veins frequently hold a parallel course to these, while an occasional flexure occurs in those cases where the vein crosses them; the edges being incurvated from the thicker part, or the root of the vein, towards its termination. Lastly, in cases, of which an example was described in Tirey, where a vein traverses a mass of limestone included in the gneiss, it disturbs that substance as well as the surrounding rock; and in another parallel instance noticed in Scalpa, where the included substance is serpentine, the vein itself undergoes a change by participating in the nature of that rock during its passage.

It may now be remarked respecting these veins, that although they sometimes resemble ordinary granite, they more generally possess a distinct character, consisting chiefly in the larger size and more decided crystallization of their constituent parts. It is in these that the large concretions of mica and of felspar are almost always found. I have rarely observed that in the granite veins of gneiss there is any difference of texture between the middle and the exterior parts, although in those that traverse other rocks and can be traced to granite masses, this feature is common. The same rule holds respecting the larger and smaller veins, which in gneiss possess indifferently a similar texture, while in other rocks the texture is minute, generally, in proportion to the vein. Many of the veins in gneiss consist of felspar and quartz without mica or hornblende; in all, these minerals are predominant.

Graphic granite is much more frequent in the veins that traverse gneiss than in the others, although not absolutely limited to these. The felspar is generally the predominant substance in this class of veins and often presents a common polarity throughout the whole mass, as already noticed in Coll. The mutual disposition of the felspar and quartz is various. Occasionally it is partially laminar, as in Rona; more commonly the quartz is in prismatic forms, triangular or hexagonal, or occasionally, even hollow and filled with felspar. In a very few instances the summits of the quartz crystals are perfect, and protrude into a vacant space. From considering the relative forms of the quartz and felspar it will sometimes appear that the one and sometimes that the other has first crystallized, and thus determined the shape of its associate.

Gneiss, considered as a rock, alternates with many substances generally inferior in quantity, to which the arbitrary term subordinate has been applied. Sometimes however it is inferior in quantity to those very rocks, and might therefore with equal justice be considered the subordinate substance. It is difficult to draw a sufficient line of distinction between those alternations which may be supposed to form a part of gneiss, considered as a geological formation, and those which ought to be viewed as alternating formations. Perhaps the following criterion may be deemed a just one. Where the interstratified substances follow all its contortions and are traversed by the same granite veins, the whole may be considered as one rock-formation, and may be included in geological description under the common term gneiss. On the contrary, when the other rocks that accompany it form distinct masses, however slightly confounded at the point of change, are free from the irregularities and veins that attend the gneiss, or are succeeded after such alternation by independent masses of the same rock, or of others usually associated with them, they may be supposed to belong to a different series.

In the first of these divisions, hornblende schist is by far the most abundant rock, and it appears to predominate chiefly where the gneiss itself contains hornblende as an ingredient. Under this head are ranked the compound schists sometimes known by the name of primitive greenstone. Actinolite schist occurs in a similar manner, but is rare. Micaceous schist must also be ranked with these substances, however difficult it may sometimes be to distinguish it from the schistose varieties of gneiss. Limestone also occurs in the same manner, but in large irregular masses more frequently than in distinct beds. Lastly, quartz is occasionally found interstratified with gneiss, sometimes simple, at others interspersed with crystals of felspar or with hornblende and felspar both. The circumstances under which it is undistinguishable from granite have already been stated and do not justify the notion that this rock is actually interstratified with it, either as part of the series or as a distinctly alternating substance.

But the most important part of the geological history of gneiss is that which is included under the second division and which relates to its position with regard to other rocks, whether in the order of precedence, succession, or alternation. It seems to occur in immediate subjacence to all the primary strata, and, in Scotland at least, to the secondary also. The instances in which it is succeeded by micaceous schist and quartz rock are so common as not to need enumeration. In Lewis and North Uist, it immediately precedes argillaceous schist, as it also does in several other parts of Scotland. In Perthshire and in Sutherland it is followed by primary limestone, and by the primary red sandstone; and, in Morven, it is covered by an extensive tract of that conchiferous limestone accompanied by white sandstone and coal, which occurs in a dispersed manner throughout this coast.

Occasionally it reposes on granite, but not exclusively; since the granite of Scotland is followed, in some situation or other, by every one of the primary strata: and that it does not necessarily succeed any one rock, will be proved by the history of its alternations.

With micaceous schist and quartz rock these are so frequent that examples need not be pointed out. In Isla the gneiss is imbedded in masses of argillaceous schist, or occurs in frequent repetitions with that rock; while in Iona, the schist which is interposed between the granite and the gneiss, is also imbedded in the latter, as it frequently moreover is found, at Loch Eribol, Loch Carron, and in other places, in a much more extensive and unquestionable manner. In Perthshire the gneiss and the limestone alternate on so large a scale that the latter cannot be considered as a subordinate rock. The gneiss of Sutherland and Ross-shire also alternate with limestone, and in the same districts there is a perpetual interchange of its beds with those of the primary red sandstone and of quartz rock. In Sky it has been shown to graduate into these latter rocks, as well as into argillaceous and chlorite schists.

With respect to its history as a rock species, the most important question is, to what extent it partakes of the nature of a mechanical deposit, or whether it may be considered as purely chemical. There are in this case two grounds of judgment, the form of the rock and its internal structure. In the first circumstance it resembles those rocks of later origin of which the mechanical nature is unquestionable. But even these present in many cases, whether they are primary or secondary, the indications of a chemical nature combined with a mechanical structure. So far therefore the mineral composition of gneiss presents no argument against the belief that it was originally deposited in a manner similar to that of the other stratified rocks; a supposition confirmed by the prolonged and parallel direction which it bears to these throughout the whole of Scotland. A stronger confirmation of this is supplied by the appearances of some of the rocks with which it alternates. It will hereafter appear in the history of the red primary sandstone, that some of the beds of that substance bear the same marks of undulation on the surface which characterize the secondary sandstone and prove its deposition from water, these being found in alternation with the gneiss of that district in which it occurs. It will also be shown in the history of Garvh Island, that a rock containing organic remains is found in a similar position; both instances equally proving that like those strata it must originally have been deposited from water, whatever changes it may since have undergone. With respect to internal character, it has not hitherto, I believe, presented any decided marks of that mechanical arrangement, which, with the exception perhaps of limestone, are occasionally present in every other stratified rock. I shall hereafter show that the parallelism of mica is not a proof of such arrangement, since that mineral occurs in this manner in veins of porphyry and of trap. The conglomerate gneiss described in Rasay, and also found in Morven, appears to be of posterior formation, and to be analogous to the local attached breccias so frequent in limestone. But this is not the place, under the present dearth of information on this and similar subjects, to enter into any further speculations, and I shall therefore proceed to such an arrangement of the individuals of this family as my present state of information admits.

Before enumerating the several rocks here united under the general term of gneiss, it is however proper to say that the limits of the definition have been considerably extended. This seems unavoidable, since the varying composition of the rock and the gradual nature of the changes it undergoes, render it impossible to apply separate terms to each variety, without accumulating a load of titles which would encumber instead of elucidating the subject. Nor is there any reason why the definition should not be so extended, since no rigidity has been held necessary in the case of other compound rocks where variations even greater are of common occurrence. In enumerating the varieties I have however separated the most anomalous from those which, with greater simplicity and regularity of structure, exhibit in a great measure, if not entirely, a composition corresponding to the ordinary definition of this substance. It is for geologists to receive or reject this arrangement as they shall see right; it can only be offered as a very imperfect attempt towards the attainment of the object, since it is founded on observations limited not only to Scotland but to a small part of that country.

In the first division are placed all those of which the composition may be considered regular, as being identical with that of granite: the second contains those that are characterized chiefly by the presence of compact felspar; and the third includes all which, with a community of structure and geological position, present a different variety or combination of ingredients: of these last the greater number will be found to pass by insensible degrees into the more regular kinds.

The first division is subdivided into three parts, each of them being characterized by a peculiarity of structure.

The granitic subdivision is that which prevails throughout the islands now described, and it is characterized, not only by a large grain and imperfectly foliated structure, but by frequent partial transitions into granite, from which, when in detached specimens, it cannot sometimes be distinguished.

The second, or schistose subdivision, occurs principally on the mainland of Scotland, in numerous situations; alternating with and graduating into micaceous schist and into quartz rock; in some cases so frequently, that it is impossible, in describing or in mapping a given district, to say under which head the rocks ought to be enumerated. In its general aspect it is small grained; with a granular texture when connected with quartz rock, and with a distinctly laminar one when it passes into micaceous schist. The felspar can in many cases only be distinguished from the quartz by its decomposition on the weathered surfaces; and, when these are not accessible, this gneiss is easily confounded with the one or the other of the two rocks above mentioned.

The last subdivision, or the laminar, seems to be of more limited occurrence, but it may be seen in Rona, in Sky, in Ardgower, and in other places. It is characterized by the laminar alternating disposition of the ingredients; the specimens often exhibiting in consequence of this arrangement, singular and beautiful combinations of colour.

It will be perceived that, as in the case of granite, I have here admitted hornblende together with mica as participating in the composition of regular gneiss. In fact this mineral is more prevalent than mica in the gneiss of the Western isles; nor does there appear any reason in this case more than in that of granite, for creating a new species. While the component parts vary in both cases, the continuity and geological relations of both the rocks continue unaltered.

On a first view the varieties in the aspect of gneiss are so numerous that it would appear impossible to refer them all to the following list. Yet, when strictly examined, it will be found that these diversities, as in the case of granite, arise from variations in colour, proportion, disposition, and size of the constituent parts; circumstances evidently capable, under their possible combinations, of producing varieties that may fairly be considered infinite.

I have only to add as a preliminary to the synoptic table that the second division contains two subdivisions, and that the third presents subdivisions of structure similar to the first, although not sufficiently constant, or extensive in a geological view, to require a formal arrangement in the present sketch.

SYNOPSIS OF GNEISS.

FIRST DIVISION.

Of regular composition, containing at least three of the four minerals, quartz, felspar, mica and hornblende.

First Subdivision.—*Granitic.*

Resembling granite, i. e. large grained and often losing the foliated structure.

A. Quartz, felspar, mica.
B. Quartz, felspar, hornblende.
C. Quartz, felspar, mica, hornblende.

These varieties abound in the Long Island. They sometimes contain superadded crystals of felspar, thus forming the porphyritic gneiss of some authors.

Second Subdivision.—*Schistose.*

The structure laminar, like that of micaceous schist, or granular with a slight laminar tendency, like that of quartz rock:—fine grained.

A. White felspar and quartz in minute grains intimately mixed, with rare scales of mica. The position of the mica determines the foliated structure, which is however often so very indistinct that the specimens can scarcely be distinguished from quartz rock.

B. The mixture of felspar and quartz finely granular as in the former, but the mica so abundant as to cause it to resemble certain varieties of micaceous schist.

C. The mica so abundant as to form distinct continuous laminæ; and as in these cases it is often very difficult to distinguish the felspar from the quartz, the specimens are easily confounded with common micaceous schist.

D. A schist of foliated mica, with interspersed and large irregular crystals of felspar; the quartz being scarcely discernible.

It may be added that the whole of this subdivision present transitions from gneiss into quartz rock and into micaceous schist. Where the felspar is red they are easily distinguished: when white, it is much more difficult to recognise them. I may also add that hornblende is, as in the first division, an occasional ingredient.

This variety occurs abundantly on the west coast of Scotland, in Rannoch, and in the middle Highland districts of Atholl and Badenoch.

THIRD SUBDIVISION.—*Laminar.*

In the two former subdivisions, either the whole mass has a granular structure combined with the foliated, the latter arising from the position of the mica, or the hornblende; or else the quartz and felspar form one granular mass, separated into laminæ more or less defined, by the mica, or by the hornblende. In the present, each substance occupies a distinct lamina, the quartz and the felspar being separated; sometimes remaining in contact, at others being divided by intervening laminæ of mica or of hornblende. This variety is generally remarkable from the contrast and disposition of the substances, and the quartz frequently puts on the muddy aspect of chalcedony.

* A. Quartz and felspar in alternating laminæ.
B. Quartz, felspar and mica, similarly alternating.
C. Quartz, felspar and hornblende, disposed in the same manner.
* D. Felspar and hornblende in alternating laminæ.

The varieties A, B, are abundant in Glen Elg, Rona and Ardgower; the third occurs occasionally in various situations. The quartz is also found alternating with mica only or with hornblende only, in the same situations; but it is scarcely necessary to specify these varieties as they appear to be very limited in extent.

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* These might with perhaps more propriety be placed in the third division.

With respect to the first division I may add, that the several varieties enumerated under it are occasionally found passing into each other, in all situations where gneiss occurs; notwithstanding the leading prevalence of one or other of the subdivisions.

SECOND DIVISION.

Of irregular composition, containing compacted and compact felspar.

FIRST SUBDIVISION.

Containing compacted felspar united to the ordinary ingredients of gneiss; the structure granitic or else partially schistose.

A. Compacted granular felspar with or without quartz, and interlaminated with hornblende.
B. The same with mica instead of hornblende.
C. The same with both mica and hornblende.

The varieties here included are far less common than the granitic or schistose gneiss, but they occur nevertheless in considerable quantity in Sutherland and in Ross-shire, very often in company with those of the following subdivision. The essential distinction between them and the ordinary varieties of gneiss consists in the condition of the felspar, which is disposed in small crystalline particles, often of a glassy lustre, compacted into a dense and somewhat granular aggregate. Hence it is distinguished by the name of compacted felspar, a term which expresses this peculiarity without confounding it with ordinary compact felspar. These rocks all present a very decided character by which they are easily distinguished from the more common varieties of gneiss.

SECOND SUBDIVISION.

Consisting of compact felspar united to the ordinary ingredients of gneiss. In structure it sometimes resembles common gneiss, but more frequently its fracture is like that of the non-fissile schists, presenting no indication of laminæ.

A. Compact felspar with hornblende.
B. The same with hornblende and mica.
C. Compacted and compact felspar united.
D. A granular and laminated mixture of compact felspar of different colours.—Perhaps this rock should rather be arranged with the compact felspars.
E. This includes those varieties of gneiss formerly described, in which compact felspar is superadded to all the ordinary ingredients.

The substances ranked in this subdivision are frequently traversed by veins of compact felspar, often reticulating in an intricate manner, and so numerous as to form a large proportion of the rock. The predominant colours in this compact felspar are various shades of grey, but the green variety formerly described is also very common. They occur abundantly, sometimes in connexion with the varieties of the first subdivision, in Sutherland and Ross-shire; and are particularly conspicuous on the borders of Loch Mare, where they are associated with a fine hornblende schist that occasionally passes into a substance scarcely distinguishable from the argillaceous slates. They have already been pointed out in North Uist and West Rona.

THIRD DIVISION.

Of irregular composition, being either deficient in the number of ingredients required to meet the definition of gneiss, or containing some substance not included in that definition.

A. Quartz and felspar; simply laminar and at the same time granular. The foliated disposition here results from the crystalline position of the felspar.

B. Hornblende and felspar, foliated and sometimes imperfectly schistose. Analogy and geological connexions claim a place here for this rock; it is however the primitive greenstone of some and the hornblende schist of other authors.
C. Felspar and mica.—Long island.
D. Felspar and clay slate.—Isla, Lewis.
E. Felspar and chlorite schist.—Gigha, Sky.
F. Felspar, quartz and chlorite schist.—Sky.
G. Felspar, quartz and clay slate.—North Uist.
H. Felspar, quartz and talc. —Scalpa, (West.)
I. A granular mixture of felspar and quartz in one lamina and clay slate in another.
K. The same with chlorite schist or greywacké slate instead of clay slate.—Sky.
L. Compact quartz with imbedded grains of felspar, in one lamina, and the same schists in the other.—Sky.
M. Schistose felspar containing crystals of hornblende interspersed.
N. Actinolite occupying the place of hornblende.—Sutherland.

Of all these I may remark, that the geological position and general features are the same as those of the most regular gneiss, and that they often pass into the regular varieties.*

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* It is perhaps superfluous to remark, that although I have thus distinguished the varieties of gneiss by fixed divisions, there are, as in all cases of compound rocks, intermediate gradations which cannot be decidedly referred to either. But I may observe that many other combinations probably exist, and that an ideal catalogue of much greater extent might easily have been formed. The present enumera-

No division is here made of those varieties which contain occasional minerals, however abundant, or in whatever manner disposed, since these must be considered as accidental not essential substances. The following minerals are those of most usual occurrence: —

Garnet.—This is found either diffused through the mass, or crystallized and disposed in a laminar manner, or irregularly scattered.

Actinolite.—This mineral occurs under various forms, sometimes, as above noticed, as a substitute for hornblende.

Quartz.—The quartz occurring in gneiss is often marked by peculiar characters. The most common is a slight opacity varying from a waxy to a chalcedonic and to an opalescent appearance. This is particularly the case in the laminar subdivision. It has sometimes but improperly been termed chalcedony. The milk quartz of mineralogists, of whatever colour, belongs to this variety, and is, I believe, always an inmate of gneiss. It also occurs very finely granular, as was noticed in Harris. In the vicinity of Loch Mare, fetid quartz, similar to that of Nantes, is not uncommon, its smell on friction somewhat resembling that of putrid sea weed. The quartz is also found of various colours in the gneiss of the north-western coast and in that of the Long Isle. The prevailing are the various shades of ash grey, varying gradually from the lightest tint to jet black, in which last state it occurs in the gneiss of Ben Lair in Ross-shire; but very rarely. Next to these the most common colours are reds, varying from a pale claret to a dilute pink. French grey is less common; it was mentioned as found in North Rona, and it also occurs in the gneiss of Glen Tilt. In one of the islands of Loch Hourn I observed it of a dilute green,

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tion has been rigidly limited to the varieties actually observed. It is evident that some of them would equally admit of being ranked with other rocks, but such are the transitions of these compounded bodies that every arrangement must be subject to this kind of imperfection.

passing gradually into dark bottle green and thus forming the prase of mineralogists; the colour appearing to be derived from the actinolite schist with which it was associated in the rock.

Felspar.—Gneiss appears to be the natural repository of the principal varieties of this substance, which is sometimes, but not necessarily, connected with the granite veins.

Oxidulous Iron.—This occurs so abundantly at times as to form a constituent part of the rock.

Hornblende—Occurs chiefly as a part of the alternating beds of hornblende schist, but is occasionally found in distinct concretions and in the form of perfect crystals.

Fluor Spar—Is not common, but occurs in the gneiss of Sutherland, sometimes aggregated in lumps, at others diffused throughout with the other ingredients.

Zircon.—I have also found this mineral in the gneiss of Sutherland.

Tourmalin.—This seems to occur but seldom; the crystals, though small, are in general extremely perfect.

Epidote.—This mineral occurs in the gneiss of Sutherland, often in such abundance as to form a constituent of the rock.

Pyrites—Is sometimes, but rarely, found dispersed; and commonly in those varieties that contain hornblende.

Molybdena.—This rare mineral is found in the gneiss of Baffin's Three islands, dispersed in minute grains among the other constituent parts.

Many other minerals have been occasionally described as found in gneiss, but the true repositories of these are the granite veins: or, at least, sufficient care has not been taken so to distinguish between the two cases, as to admit of their being here enumerated. The preceding list includes those which I have observed in the gneiss itself.

INTRODUCTORY REMARKS ON THE TRAP ISLANDS.*

IN giving to this group the name of the Trap islands I have been guided by the nature of the predominant rock; although it will appear when the individuals are described, that some of them, as Pabba for example, contain no masses of that substance. But since, together with trap, some of these islands present conspicuous and interesting tracts both of the primary and secondary rocks, the illustration of which depends in a great measure on the structure of all the neighbouring parts jointly considered; the few here included, in which that rock is not present, could not have been omitted without inconvenience: the deficiency of arrangement is fully compensated by the advantage gained in point of illustration.

Before proceeding to consider these islands in detail, it will not be unprofitable to take a general view of the relations which they bear to each other, and to the continent near which they lie. To aid this view the general Map may be consulted.

The trap is obviously divided into two principal groups, Sky being the centre of the one and Mull of the other; these being however connected by detached masses occupying either the intermediate islands or parts of the continent. The Shiant isles and the remarkable rocks at Loch Maddy formerly described, are found at the outskirts of this boundary, from which however St. Kilda may be excluded, on account of its total want of probable connexion.

The first feature which arrests the attention in considering these islands, is the nonconformity of outline they present to the general north-easterly bearings of the coasts, which have already been stated in a cursory way to depend on the direction of the strata, and will hereafter be more fully seen to proceed from that circumstance. This contrast is peculiarly remarkable in Sky, where the larger part of the island presents a tendency different from that of the smaller portion. The former consists of trap; whereas the latter is formed of the stratified rocks both primary and secondary, and maintains its general position with respect to the continent; preserving, as will hereafter be shown, the regular directions of those rocks where they occur in more continuous masses.

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* See the table at the commencement of this work, and also the general Map.

The nonconformity of the outline of Mull is less apparent; yet its longest shore, which together with the opposite land of Morven includes the Sound, will also be seen to form a large angle with the predominant lines of the western coast.

On the same map the extent of the secondary strata may be traced, and it is apparent that there is a very general coincidence between the two classes of rock, or that the trap is confined, with but slight exceptions, within the same limits as the secondary region. The only portion at much variance with that rule is the porphyritic district of Glenco, on the mainland; but of the real connexion of this with the Trap islands there are considerable doubts, which I shall have occasion to state hereafter.

Our present knowledge of the trap rocks is perhaps not yet sufficiently extensive to allow us to speculate on this connexion between them and the secondary strata. We have no reasons *à priori* to expect that they should be found in this situation exclusively, nor is the rule indeed by any means universal; yet it is remarkable that in Scotland as well as in the neighbouring country, Ireland, almost all the great overlying districts of trap are principally connected with these strata. If we consider the probable causes in which they have originated, there is no apparent reason why they should not be equally found overlying the rocks of primary formation; nor indeed, on any view of the causes of their deposition, is this circumstance to be explained; since, being the uppermost of all rocks and the last in point of time, they might be expected equally to cover all those whose limits in elevation do not exceed the utmost height at which they are found to exist. Although this connexion should even prove very partial it is not the less worthy of the attention of geologists; but the solution, like that of a thousand other difficulties which attend this infant science, must be expected from future acquisitions of knowledge.

Whatever connexions more intimate than those at present visible, may exist among the several detached portions of trap, as they occupy either the islands or the shores of the neighbouring continent, are for ever concealed from us by the insuperable obstacle which the ocean throws in our way. Hence it is impossible to judge whether the Maddies and the Shiant isles are now connected beneath the sea with Sky, or whether they have ever been so united. The occurrence of St. Kilda, so far remote from the whole, might perhaps rather induce us to adopt the contrary belief, and to consider them as independent formations.

Contemplating the Trap islands in this general view, the occurrence of the veins of that substance is not the least interesting part of the subject. These are notoriously common in the Western islands. I have pointed out many of them already in the Gneiss islands, and they will hereafter be shown to be even more frequent in the other islands of this sea. Wherever they are found, they seem to abound most in the vicinity of the great masses of trap. As proofs of this, I may quote their greater rarity in the remote parts of the Lewis than in the Schistose islands, which lie in the vicinity of Mull; and their frequency in Arran and the stratified parts of Sky, compared with their more sparing occurrence as we recede from those central masses. I shall indeed hereafter show, that their numbers can scarcely be reckoned in the immediate vicinity of many of the masses of trap in Sky and in Arran; while they disappear in succession as we remove from these, their progress being generally limited, although in a few instances surprisingly persevering.* Hence we may infer, that these veins are processes from the main bodies of trap; and this view is occasionally confirmed by the facility with which they can be traced to their sources, examples of which are of frequent occurrence in Sky and in the islands on the coast of Lorn. It is not however pretended that this origin is universal, since it is equally certain that two distinct sets of trap veins exist; the posteriority of the one being proved by its traversing the other, as well as by its distinctly intersecting the great masses themselves. It is possible that many of the more remote and persistent veins may be of the secondary order, but of this we are not likely to obtain any proofs.

I shall now proceed with the details of the individuals, commencing with Rasay, and treating of them successively in that order which, however irregular it may appear, seems most conducive to their mutual illustration.

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* The Argyllshire coast presents a striking illustration of this fact. They are exceedingly rare between the Mull of Cantyre and Crinan; but beyond this they begin to prevail, and as we approach the great mass which covers Mid Lorn, they occur in great abundance, increasing in number and magnitude in proportion to their vicinity to that extensive tract of the parent rock.

RASAY.[*]

The natural affinity of composition subsisting between the northern division of this island and Rona, has, together with their intimate geographical connexion, induced me to describe it next in the order of succession, and first therefore of the Trap islands. By adopting the course which I have followed in this and other cases, although the order of arrangement may at first sight often appear capricious, it will be seen that considerable facility is afforded towards understanding, not only the structure of the individuals, but the more important relations they bear to each other; as well as in reducing their scattered and insulated materials into one whole. There are many obscurities in the composition of one island which can only be removed by the knowledge of another; and by thus proceeding from a base to a superstructure, the reader will immediately comprehend many points which I did not arrive at till after much circuitous labour and many comparisons. Sky, the most prominent and important feature in this group, is, from its construction, from the scattered nature of its details, and from the frequent disappearance of the regular strata in consequence of the presence of the irregular rocks, a fund of obscurity; while, being the centre to which so many parts tend, it is the most in need of illustration. Rasay, though interesting also in itself, becomes here a principal object, by its collateral and secondary uses; and its value in this respect will be hereafter apparent when I shall attempt to investigate the structure of the former island.[†]

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[*] Rasay—Raasay, properly—from Raa, a roe or deer.—Danish. See the Map of Sky.

[†] So much in geological investigation depends on the truth of maps, that there is great reason to lament the general incorrectness of the maps and charts of this coast. In no instance is the defect more

This island is estimated to be fifteen miles in length, and where widest, three in breadth. Neither of its longest shores differs much from an uniform line; but the differences, slight as they are, and therefore the less noted in the maps, are peculiarly important to a geologist, as they are connected with changes in the nature of the rocks, the relations of which they serve at the same time to compare and determine.

It may be considered as forming a single ridge, though irregular and unequal in elevation at its different extremities; the change, which is somewhat sudden, taking place near Brochel Castle and being accompanied by a corresponding difference in the rocks which form the two divisions. The average height of the highest and southern division may be estimated at 1000 feet or thereabout, and it presents, when viewed from the south-east, the outline of a high table land surmounted by the single flat-topped eminence of Dun Can, of which the height appears to attain about 1500 feet. But it declines towards the west by a general slope, terminating in low shores; while the eastern side is, for the greater part, bounded by a long range of cliffs of a mural character, intermixed with those grassy slopes which are here, as in similar cases, the result of the degradation of the rocks. In the interior of the island, narrow as it is, are many irregular eminences, mixed with others of a character so particular as

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felt than in the island under review; the inaccuracy of its map being so great, that it is almost impossible to reconcile any of the actual bearings with those that are given; and, consequently, to pursue from place to place those detached portions of any individual rock which it is important to trace accurately. The same cause renders it impossible to give a true topographic detail of the rocks, but as great nicety in this respect is not very essential, the reader must be content to take them with that latitude, both of position and dimension, which alone is attainable. There being a total want of an interior survey, there can of course be no local references. I have corrected some parts of the present map which stood particularly in need of it, but they bear so small a proportion to the whole, that it must still remain what it was, a mass of deformity.

to be worthy of notice. These are long narrow ridges parallel to the sides of the island, divided by deep valleys in such a manner, that the toil of traversing them can only be compared to that of alternately descending and surmounting the ridgy waves of a long and deep-rolling sea. This appearance is interesting independently of its general features; as it will be found to be in a great measure regulated by the places of the porphyritic rocks which lie over the sandstone that constitutes the basis of the island.* The northern part of Rasay, consisting of gneiss, presents those naked and rounded, yet evenly disposed rocky eminences, which characterize Rona and the low islands formed of the same rock that have already been described in the beginning of this work.

The west side of the island has a most uninteresting aspect; presenting long ridges of grey rock ill diversified by the brown hue of the heath and the arid yellow of the Scirpus cæspitosus, the joint tenants of similar soils. The east side is, on the contrary, covered with scattered farms; each surrounded with its cultivated tract, and the whole diversified by towering rocks, formidable cliffs, and patches of brushwood. On this side, scenes of considerable grandeur occur, generally marked by great breadth and simplicity of manner, and by powerful effect; at times however verging to an artificial character, in the architectural regularity of the flat sandstone cliffs, which are frequently split into columnar and conical forms, rising like towers above the deep dark sea that washes their bases. The houses perched on these summits seem more like the retreats of the birds that hover round them than the habitations of human beings; the eye from below scarcely distinguishing them, far less their inhabitants.

The grandeur of these long extended walls of rock is often varied by the enormous fractures and dislocations which have at different times taken place; masses of immense bulk having been occasionally separated so as to form a second ridge below them; while, in other places, huge piles of ruin cover their slopes with fragments, advancing far into the sea and strewing the shore with rocks. None of the islands, not even Sky itself, illustrates so strongly the magnitude of the changes that take place from the operation of daily causes; changes however, which, although more palpable, are not perhaps more effectual than those which occur in many situations where they do not carry so strong and permanent a record with them.

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* Pl. XIII. fig. 6.

Excepting these, there are few marks of waste in the island; as it gives rise to no rivers worthy of notice, and the mountain rains, reaching the sea soon after they have quitted the clouds by courses the most easy and direct, leave few traces of their ravages. At its southern extremity is found an alluvium of rolled stones, forming a sea bank of an origin which is not apparent; since it is not connected with any river, and is far too high to have been thrown up by the tides. A similar one, but of smaller extent, is found near Clachan. These are, possibly, the remains of some more extensive deposit of a diluvian nature; a circumstance rarely occurring in the Western islands, but of which another example still more remarkable will hereafter be pointed out in Sky.

In describing the geological structure of Rasay* I shall commence with the gneiss; since by means of this rock it is connected with Rona, and since this is also the lowest substance in the island. It occupies the whole of the northern extremity, and is defined at its southern boundary by a line drawn from Brochel Castle in a N. by W. direction, passing through the Lake of the Reeds and crossing the narrow sound which separates Rasay from Flodda. This boundary is not however rectilinear, as the gneiss occasionally intrudes within that space, which, on account of the regular bearing of the strata that immediately follow it, we should have expected to find an uninterrupted mass of sandstone. On the eastern side of the island it appears to be disposed in beds of considerable regularity, conforming to the sandstone, lying with their elevated edges, as nearly as could be ascertained, in the direction of N. by W., and dipping E. by N. The angle may be taken on an average at 40°. I do not speak with confidence respecting the direction of the gneiss, since it does not appear to be disposed with that linear exactness so remarkable in Sky, nor, as in that island, to run with the same parallel nicety to the sandstone. On the contrary, in many places, and particularly towards the northern extremity of the island, its position becomes uncertain and irregular as in Rona.

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* Pl. XIII. fig. 4, 5.

Having given a sufficient description of the mineral characters of this rock when speaking of Rona, with which Rasay is geologically continuous, I shall here content myself with barely mentioning that, in addition to those, it exhibits various alternations of hornblende schist and of the various compounds which have already so often fallen under review in describing the westernmost chain of islands.

The red sandstone, commencing where the gneiss terminates, is disposed, as far as its boundary is concerned, in the same linear direction, with the exceptions already noticed; that line being nearly N. by W.: but the nature of the ground, which often prevents the elevated edges from being seen, prevents also the contact from being ascertained. The direction of the strata follows that of the boundary, and appears, throughout the whole space occupied by this rock, to be N. by W., although in some places it seems to become occasionally N. and N.N.W.; variations, if they really exist, arising in all probability from those undulations to which strata are so often subject. It exhibits the same regularity on the western as on the eastern side of the island; and, as there is no other method of reference, I must trust to the map to point out the space it occupies. The dip is every where to the westward, but varies in the quantity of the angle. On the eastern side it is generally considerable, averaging perhaps 40°, while towards the west it becomes less, and in some cases subsides as low as to 10°. As the dip of the gneiss is towards the east where it lies near the sandstone, it is evident that they occupy reverse positions. Where the red sandstone terminates on the western shore it is followed by a white sandstone in a manner that will be described hereafter.

Red sandstone occurs in two other places in Rasay; and it is particularly interesting to trace these portions, as their positions, while they are somewhat obscure, are important, from the connexion which they establish between the northern tract just described and an extensive series of beds that will be shown to predominate in Scalpa and to occupy a large part of Sky as well as of the neighbouring mainland.

The first of these, as being the nearest to the main body, is a very small portion occupying a nameless point in the map; its dimensions do not exceed a few hundred yards and it is accompanied by a portion of the usual conglomerate. The angle of elevation of the beds, of which the dip is also westerly, is scarcely 20°; and from that circumstance, as well as from the small quantity of the rock visible, it is difficult to ascertain truly the direction, which however appears to be about N. by E. It is equally difficult to determine the true relative place of this portion of sandstone to the other strata, as it is separated by a chasm from the white sandstone that lies near it. If this be attempted by prolonging the planes of the beds, it seems rather to be continuous with than subjacent to that rock, but as it bears marks of disturbance, and as the white sandstone is occasionally irregular, that position may be considered as accidental. We are at least entitled by analogy to class this with the former red sandstone, as a portion of a line extending round the east side of the island, the remainder of which, to the southward, will be immediately described. In this respect it becomes interesting, as it might otherwise remain a doubt incapable of solution, whether the northern and southern red sandstone of Rasay were parts of the same deposit; and, consequently, what relation the northern portion bore to the more distant rocks of the same nature to which I have already alluded.

The extent and position of the last and southern division of this rock are also marked on the map, where it is seen lying opposite to the neighbouring shore of Scalpa. The line of direction here undergoes a change, becoming more easterly and appearing to lie about N. E. by E.; although, from the imperfect manner in which it is displayed, this cannot be precisely ascertained. If it be as here stated, it approaches more nearly to the direction of the same rock on the shore of Scalpa, the line of bearing being there N. E. half E. Considering the proximity of these coasts, and the continuous extent of this rock to the southward, it is probable that, on both, it belongs to a common deposit; and that these detached portions are connected by a regular succession of beds in those parts of the surface which are invisible by reason of the intervening sea. It must nevertheless be remarked, that while the dip of this sandstone in Rasay is uniformly towards the west, it varies in Scalpa; a circumstance however which will not invalidate that conjecture, as in Sky, the same rock is subject to frequent and even sudden reversals of position. To extend the analogy between this southern portion of sandstone and the two already described, I may add, that, like these, it is immediately followed by the same strata of white sandstone.

In recurring to the differences of direction of the strata in these three portions, it will be seen that they amount to six points of the compass, or upwards of 60°. If therefore we consider them as detached parts of one set of beds, it is evident that these are incurvated in their course; a circumstance not very unusual, since similar irregularities have been already pointed out in gneiss in various places, and will hereafter be shown to occur among the strata of the Schistose islands. If this be a true representation of the position and connexion of the red sandstone in Rasay, its eastern shore, if sufficiently extended, would be surrounded with that rock, as I have already hinted;* while, if a section adapted to the purpose could any where be discovered, it would be seen to pass under the white sandstone, which would thus be found contained within it on this side as in a basin. It equally follows, that it constitutes the upper part of a great deposit of red sandstone which reaches to the Kyles of Sky and the mainland; but I shall have occasion to discuss this question at more length hereafter.

Having thus attempted to ascertain the geological history of this series, I must describe the particular substances which belong to it; having adopted the former general term, as on other occasions, to facilitate the description, without meaning to confound different mineral substances under one name.

At the points of contact with the gneiss there is found a very small portion of a conglomerate, which occurs in similar situations in Sutherland, in Ross-shire, and in Morven; and which might have been enumerated with the varieties of the gneiss, since it is intimately connected with that rock. It is entirely formed of fragments of this substance, broken and reunited with very little change of character; being of an equal degree of compactness, while, at the same time, it can scarcely be separated from the principal rock. It seems to be as partially distributed as it is small in quantity. In the same situation there is found an equally small quantity of a finer conglomerate, apparently as partial, formed of dark red felspar and hornblende schist equally mixed in distinct fragments, and producing, from the contrast of colour, a very peculiar appearance.*

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* See the Map.

But the first conglomerate that forms a part of the sandstone beds, is found immediately above these; presenting some detached and elevated rocks of a very remarkable character, on one of which is situated the very whimsical and picturesque structure, Brochel Castle, the ancient seat of Macleod of Rasay. This building is so contrived as to cover the whole summit of the sharp eminence on which it stands; its walls being continuous with the precipitous faces of the rock. The projections of these have been so contrived as to form parts of the building; and they are at the same time so like in appearance to the masonry of which it is constructed, that it is often difficult to distinguish between the artificial and the natural wall.† This rock is composed of the usual fragments that enter into the conglomerate in other places, but it appears to be very partial; as in many parts of the line of junction the fine sandstone is found in immediate contact with the gneiss without any intervening substance. At the same time it bears no marks of stratification; while its permanence, standing highly elevated as it does in pinnacles far above the surrounding rocks, shows, that with a texture apparently feeble and loose, it must possess much greater durability than the surrounding rocks, of the destruction of which it now remains a monument.‡

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* An extensive examination of the western shore of the mainland has since convinced me that these conglomerates appertain to the red sandstone, as they occur in most places where the contact of that substance with the gneiss can be fairly traced.—1818.

† Vide Plate II.

‡ The spiry form assumed by the conglomerate rocks on wasting is a very remarkable circumstance. I need scarcely remind the reader of Montserrat, and of the instances pointed out by Dr. Holland in Greece.

The next rock which follows this and immediately precedes the red sandstone near Brochel Castle, is a graywacké schist, forming a thin set of beds in very regular order and position, and easily examined on the sea shore throughout their whole extent. Higher in the hill, they are found in contact with the gneiss, but in other places they appear to be wanting; or, if present, the quantity is so small that it is easily overlooked in a tract so covered with heath and bog.

The substance here described is a fine graywacké slate, the laminæ being separated by mica; and it is remarkable for the number and regularity of the square and rhomboidal fragments into which it breaks. Among the beds are found two or three containing small and large fragments of gneiss and quartz, cemented by the fine slate and graduating into it. This slaty conglomerate is irregularly disposed in alternation with the fine graywacké, and is separated by a wide interval of this substance from the conglomerate formerly described; with which it appears to have no connexion in structure more than in position. It may perhaps by some geologists be called a coarse graywacké; but it differs in general character so widely from this substance, that I have preferred the use of the term conglomerate, for the purpose of avoiding the indistinctness and confusion that follow so lax a use of the former name. It is in itself a sufficient indication of the mechanical nature of the process by which the whole of the series connected with it was formed.

The position of this mass of graywacké, intermediate between the first conglomerate of the sandstone series and the great body of that rock, would seem to indicate some anomaly peculiar to this spot; but it will hereafter be seen in examining Sky, that it can only be viewed as an alternation of the graywacké and sandstone, innumerable examples of which occur throughout the whole country.

This rock is followed by the mass of red sandstone that occupies the northern part of the island already described. With respect to its structure, it will be sufficient to remark in general, that it consists in most cases of quartz sand cemented by red clay, with a small proportion of mica; being obviously formed from disintegrated granite or gneiss. In a few instances the beds appear highly condensed and crystalline, being composed of quartz and red felspar intimately united; thus presenting a further illustration of their origin, the latter having in the progress of change become the red clay which forms the cementing medium in the predominant specimens.

In terminating the history of this sandstone it may be remarked, that I have thought it unnecessary to specify the situations where a coarser gravel stone occurs, as it seems in all cases an accidental feature no way affecting the geological or mineral history of the rock. It happens occasionally in the progress of a single bed that the texture will thus vary, while in other cases the change from fine to coarse takes place in irregular alternation. Variations of colour are also here to be observed, and, like the changes of texture, they are sometimes lateral, sometimes alternate. They are not very uncommon in this rock, and will be shown hereafter to exist in Sky in a very conspicuous manner.

If there are any other portions of red sandstone to be found in Rasay, a circumstance not improbable, as many scattered pieces of the uppermost strata are to be seen in different places, there will be no difficulty in referring them to the fundamental mass; while the disturbance visible in some parts of the island will, together with the prevalence of overlying porphyry, be sufficient to account for their existence.

Peculiar circumstances in the disposition and structure of this island render it difficult to determine precisely the beds which lie next in order to the red sandstone, but by combining analogy with observation they may perhaps be discovered.

At the northern part and on its eastern side, a cultivated alluvial soil occupies the interval between the red sandstone and the white sandstone already mentioned which forms the great mass of the island. The intermediate substances, if there are any, are thus concealed from observation, and I may indeed add that the surface of the island in general is obscured by similar causes. At its southern extremity two circumstances unite to produce the same uncertainty, the vegetable soil in the interior, and, on the shore, the occurrence of a mass of porphyry, occupying a considerable space and immediately following the red sandstone at the point where the connexion must take place. It is however here if any where that it must be sought.

The strata which are here found near the porphyry consist of a dark bluish micaceous shale, alternating with a coarse limestone of the same colour containing much argillaceous earth, but, as far as I could observe, free from shells. Occasional fragments and indications of the same substances are found in the interior of the island, even as high as the foot of Dun Can hill, but in a manner so dispersed and in portions so minute, as to render it impossible to give them places in the map. To these rocks succeed white sandstone, here also interrupted and obscured by masses of porphyry; but these being abstracted as interfering substances, the regular sequence will appear to be red sandstone, shale and limestone, white sandstone. If this conclusion should appear to be founded on insufficient data, it will be justified no less by general analogy than by a comparison with the series of rocks which occurs in the neighbouring islands, the description of which will appear hereafter.

The sequence of the upper members of this series is to be seen in many parts of the eastern shore, where the same shale is found in the lowest position, immediately followed by the enormous accumulation of white sandstone which constitutes the high cliffs already described and forms the bulk of the island. Together with this shale, there are very thin beds of limestone; very impure, inasmuch as they contain clay, sand, and mica, by which they are gradually confounded with it until they entirely disappear. The shale also, gradually losing its character, passes first into a schistose sandstone of an argillo-calcareous composition, and ultimately into the white sandstone.

The organic remains found in the inferior strata of shale and limestone, are limited both in quantity and in variety; but they are most abundant in the former rock, and increase in both respects as we follow the beds upwards. The lowest of these fossil substances are a gryphite, a pecten, and a terebratula; the upper are far more numerous, and I shall here subjoin a list of them as far as it was possible to ascertain their characters from the specimens which I procured, often very mutilated and obscure.* It requires a fortunate concurrence of wind and weather to obtain any access to these rocks, and it is seldom safe to remain long where the rising of the wind or sea may prevent the possibility of returning.

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* Ammonitæ.

Pectines, some of them resembling those found near Bath and in Gloucestershire—others apparently unknown to all our conchologists.

Terebratulæ, smooth and subovate; also, plaited: neither of them definable.

Ostreæ?—the resemblance considerable, though even the genus cannot be decidedly pronounced on.

Chamæ—fragments of shells apparently of this genus.

Belemnitæ.

Gryphites.

A Cardium?

Shells resembling the genus Corbula.

Ossicula of a star fish or pentacrinites.

An unknown shell with a general resemblance to Alcyonium.

Fragments of bivalves resembling a Mya.

A shell resembling the pecten concentrica of Oxfordshire, but longer—its genus not to be ascertained.

Besides these there are numerous other fragments, but the whole are in so imperfect a state as to be incapable of examination, although they resemble generally those found in the lias of Somerset and Gloucestershire.

In a gradation from the shale follow the great beds of sandstone, of which the exterior edges are exposed along the eastern shore, forming the great range of mural cliffs already mentioned. It is not possible to obtain any where such access to these beds as to discover by what gradations they change; but while the whole series is strictly consecutive, slight variations are found in the detached parts, which seem to indicate that they become purer and whiter as they proceed upwards. The direction of the whole must be taken in a general sense as northerly, since it cannot be accurately determined; and it is thus similar to that of the red sandstone on which it lies; its dip, like that of the shale and limestone, being westerly, although no means are any where afforded of ascertaining the angle of inclination.

By comparing the very moderate dip of these beds with the altitude of the cliffs, it will be seen that there is no great difference between that altitude and their collective thickness; and as the former may be fairly estimated at 1000 feet, the depth of this mass of strata is evidently very great.

The general character of the sandstone is argillo-calcareous. It is often of a yellowish colour, but occasionally of the purest white; while towards the lower parts it is contaminated with blue clay, mica, and fragments of shale, containing also carbonized wood and a few of the organic remains already described. Large ammonitæ are also found in it, but I did not procure any specimens so perfect as to enable me to ascertain the species; if indeed it has been described by writers on conchology.* Portions of this rock are characterized by the presence of large balls, which are seen standing out on the faces of the cliffs, or lying on the shore resisting the action of the weather long after the surrounding parts have decayed. These concretions are equally common in Sky and in Egg: they do not appear to differ in composition from the surrounding substance, but are too well known to geologists to require a detailed description. Large balls of trap occur also in the sandstone, but more rarely. The surfaces of these are always decomposed, and they bear evident marks of having undergone attrition before they were deposited in their present situations. Besides these different substances, there are found pedunculated ferruginous bodies resembling Pezizæ, and doubtless appertaining to the family of alcyonia.

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* The inadmissible expense of engravings adequate to the illustration of these and many similar subjects, must be an apology for their absence.

Before dismissing this rock I must take notice of an irregular portion which is seen on the western side of the island at the junction of the red sandstone. It is of small extent, but instead of lying on that rock in the usual conformable order, it is placed on its elevated edges and dips to the eastward of south, being, consequently, unconformable to the principal mass. Such appearances are not usual among the secondary strata, but, as the porphyry occurs here, it is probably an irregularity proceeding from the intrusion of that substance. I shall not attempt further to describe those portions which appear in various parts of the island, as if detached from the main body. This is often a fallacy arising from the intricate form of the ground and from the covering of vegetable soil: in some cases it is the result of the trap and porphyry, which either cover the uppermost beds or interfere with the whole by intersecting them.

It is now necessary to take a short retrospect of the strata from the red sandstone upwards.

The limestone which occurs at Broadford immediately on that rock, and will be amply described hereafter, contains the same organic remains that are found in the lowest shale and limestone of Rasay. It must be a subject for future inquiry whether that limestone is analogous to the mountain limestone of English geologists, or whether it be the lowest of the lias series. But there can be no doubt that the upper beds of this series in Rasay, the organic bodies of which have been recently described, belong to that formation; although it rarely happens that the beds of lias are reduced to such a degree of tenuity.

The sandstone which follows possesses a very marked character, and is known in other places to succeed or accompany these latter substances, exhibiting also the same gradations of composition which here take place at the point of transition between those two sets of beds. Were any other evidence of this succession required, it would be found in Sky; on the north-eastern shore of which island the whole series of the lias will hereafter be distinctly pointed out; and in such a position as to leave little doubt of its being a part of the formation of Rasay, separated only by the intervening sea. To that description I shall refer the reader for such further remarks as may be required, and proceed to consider the porphyry and trap, as the uppermost rocks occurring in this island.

As the sandstone is found occupying the eastern side of the southern division of Rasay, so the porphyry is limited to the western, or to that part immediately opposed to Sky, where corresponding rocks are found in a similar situation occupying a considerable extent. It is equally remarkable that this porphyry is no where found among the gneiss, ceasing indeed before the red sandstone appears.

The scattered and irregular position of this rock renders it impossible to define its boundaries, either by words or on the map. I have however distinguished it by a line, which may be taken as an average of its extent; marking those places where the most remarkable junctions with the secondary strata take place, as well as the size of the drawing permitted.

In calling it the uppermost rock I have merely used this term because the principal mass lies above the sandstone: it will be seen that it penetrates through that rock, as the analogous substances trap and syenite intersect the strata of Sky, and as similar rocks will hereafter be shown to do in many places. An instance of this fact is seen not far from the house of Clachan; and again at a lower point on the shore, where it is also found lying over the sandstone; while other similar examples occur further north on the western shore. It possesses therefore, like the trap rocks, the double character of a vein and an overlying mass; or that of a mass from which veins issue to penetrate and disturb the accompanying regular rocks.

This porphyry presents no regularity of disposition, or at least no tendency to stratification. It has often indeed a foliated structure, resembling that which occurs in granite, but equally dissimilar to real stratification. Its general resemblance to granite is often very striking in other respects; particularly in the rounded surfaces and piles of prismatic bodies which it displays; while in some cases, assuming upright and rudely columnar forms, it cannot on a first view be distinguished from columnar trap.

Although I have given the general term of porphyry to the whole mass, on account of the predominance of that substance, this rock does not exclusively occupy the whole space; many portions consisting of that syenite which, equally with porphyry, is found associated with the ordinary trap rocks, and which forms by far the predominant part of that district of Sky which most resembles Rasay in character. These two rocks, formed of the same materials, and only differing in the arrangement of their parts, pass into each other by insensible degrees; but as the syenite is far inferior both in quantity and variety, and will necessarily be described under the head of Sky, I shall here limit myself to the description of the porphyry.

Its basis is a compact felspar, most commonly of a very decided character, and rarely tending to that softer variety which passes into claystone, still less into the true claystone so abundant among the porphyritic rocks of Arran. The colours being generally pale, the whole mass has a grey aspect; and, containing much less iron than the syenite of Sky, it neither moulders so readily, nor have its fragments that rusty colour which produces the arid appearance and red hue so characteristic of the syenite hills of that island. The colours of the basis are whitish grey passing to yellowish or brownish grey, and, by other shades, to greyish blue and to an obscure indigo tint. The imbedded felspar crystals are white or slightly yellow; and thus, when interspersed in dark grounds, more particularly in the blue, produce occasionally a very ornamental stone. In decay, the crystals sometimes decompose first, leaving cavities filled with ochry clay; the whole rock assuming a carious aspect. Small crystals of hornblende are sometimes contained in the base, together with crystals of quartz; and these by their various proportions produce specimens of great variety of aspect.

In the different junctions which I examined, no particular change could be traced at the planes of contact, either in the sandstone or the porphyry: if there be any, it must be both slight and of rare occurrence.

I must not conclude this description of the porphyry of Rasay, without pointing out the intimate connexion which subsists by means of it between this island and Sky; the point of Aird Bhornis, which approaches within a mile or less of Clachan Point, being formed of the same rock.*

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* A sunk rock which lies in this narrow channel appears to be a prolongation of this point, and to be formed of the same substance.

Porphyry is not the only substance incumbent on the sandstone of Rasay. Different trap rocks are also to be seen, but they bear a very small proportion to the former. The most remarkable is that which forms the summit of Dun Can hill and a small area round it, rising many hundred feet above the highest part of that land which constitutes the mass of the island. It possesses the character of an ordinary basalt, but does not admit of our tracing any other connexion between it and the surrounding rocks than mere superiority of position. Its mode of decomposition is remarkable, and, as in innumerable other instances, presents indications of an internal structure which would not be suspected from examining the fresh fracture. It is contorted, as if originally consisting of fluid materials of different densities which had been disturbed previously to their consolidation.

The only other trap rocks which I examined are found on the western shore not far from Clachan. In composition they are peculiar but not solitary, as other similar compounds will be described hereafter, and they tally precisely with a rock that occurs at Balmeanach on the opposite shore of Sky. The basis is a mixture of augit and felspar, a rock which will be amply described in

As it is very dangerous to mariners, and is not found in Mackenzie's chart, its bearings are here laid down:—

The point of Camistianevig hill	N. by E. ¼ E.
Clachan point	S.E. by S.
Aird Bhornis point	S.W. by S.
A small rock visible near the Sky shore	W. by S.

There are twenty feet of water on it at spring tides, and it breaks at low water only when the sea is running high from the north.

I have on many occasions pointed out errors in the work above mentioned, not because it is faulty, but because it is valuable, while it is the only one to which the navigator of the Western isles can trust. In the anchorages, soundings, and tides, it is generally accurate. Were some omissions in the harbours and sunk rocks supplied, and the general outline (a matter systematically neglected) rectified, it would be sufficiently perfect.

another part of this work, and which I have distinguished by the name of augit rock, to separate it from the common greenstones with which it has often been confounded. It contains, in addition to these ingredients, prehnite; sometimes dispersed in small globular concretions so as to form a constituent part of the rock, in other cases distinctly placed in cavities and imperfectly crystallized. This prehnite is most commonly of a white colour, rarely inclining to very pale green. I discovered no other independent mineral in Rasay.

Veins of trap occupying the usual positions occur in different parts of the island, but more rarely than would be expected, when we consider their abundance in Sky, and the vicinity of the great masses of trap in that island, in the neighbourhood of which they are commonly so predominant. They seemed no where to present any appearances sufficiently remarkable to be worthy of record.

FLODDA.

This small island would scarcely have had any claim to be noticed, had it not, from the greater simplicity of its structure and from affording more perfect access to its rocks, served to illustrate some points in Rasay which are not quite satisfactory, and concerning which it was necessary to add analogy to observation. Its history will also in some measure prove an introduction to that of Sky, while, by increasing the number of examples, it will show that the instances of peculiarity there to be described are not solitary.

The connexion of the graywacké schist with the sandstone is but imperfectly seen in Rasay, and for a small space; but in this little island it is displayed in great perfection. In Rasay also there is some difficulty in making the boundary of the gneiss coincide with the line of direction of the sandstone strata; while, the latter being perfectly straight and no rock but a small portion of conglomerate intervening between the two, there ought to be a perfect coincidence. The cause of this will immediately appear in describing Flodda, and I have attempted in laying down the coast to show the nature of the interruption, which arises from the intrusion of the gneiss beyond the line it might have been expected to occupy.*

This island appears to be about two miles in length and half a mile in breadth, presenting a nearly flat surface, elevated, at the utmost, fifty feet above the level of the sea. It is separated from Rasay by a narrow strait, incorrectly laid down in Mackenzie's chart, since it is dry in the middle at half tide and affords a communication between the two islands. It is surrounded by several rocky islets, all resembling it in composition. There is a perfect natural section on the side next to Rasay by which its structure is completely displayed.

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* See the Map of Sky and the adjoining islands.

The whole island is formed of the graywacké schist and red sandstone already described as found near Brochel Castle, the former however bearing a very conspicuous proportion to the latter. As it is similar to this part of Rasay in composition, so it corresponds in the inclination and direction of the strata; but the angle of elevation is lower and does not seem to exceed ten degrees, while in some places it is as low as five. As the direction of the strata is similar in both the islands, and the position of the sandstone in Rasay is regular, it might have been expected that by prolonging the outer line of the latter, the whole mass of sandstone in both would have been determined by a rectilinear boundary. This however is not the case, since the point of gneiss already mentioned protrudes across the line which should have been here uninterrupted. It is not difficult to comprehend the cause of this, if we advert to the probability that the sandstone was deposited on an uneven surface of gneiss, and that, the section parallel to the horizon, produced by the ordinary wearing of the surface, would consequently leave a protuberant mass of this rock trespassing beyond its linear boundary. The same effect would follow if we conceive the gneiss to have been elevated after the deposition of the sandstone. This circumstance will explain the irregularities that take place in Rasay at the common boundary of these rocks, which I forbore to notice in describing that island, because the appearance was neither explicit nor the cause obvious.

The graywacké that lies under the sandstone, forms a series of beds with a schistose fracture parallel to their planes of stratification, being immediately followed by that rock, without any intermediate conglomerate as in Rasay. I did not here observe it alternating with the sandstone; which is nevertheless to be expected, since in Sky and the neighbouring islands it occurs in this manner. It is of a fine and smooth texture, sometimes not to be distinguished from clay slate, except by the rare scales of mica which are found at the separation of the laminæ. There is nothing in the character of the red sandstone so different from that of Rasay as to require notice. The alternation of those two rocks where they occur in these islands, and their regular sequence in this, show that, in a geological view, they are both parts of the same series.

SKY.*

If the magnitude of Sky were not a sufficient apology for the space which its description occupies, an excuse will be found in the variety and intricacy of the rocks of which it is composed, as well as in the unexpected nature of their connexions. Such appearances do not admit of being detailed with the same brevity as those which, from their correspondence with prevailing phenomena, are capable of being referred to a numerous class of analogies. As nothing but a minute examination could have satisfied the doubts of the observer, so a corresponding description is necessary to remove or anticipate those of the reader. I have nevertheless rescinded all such observations as appeared, in this view, superfluous; while, their topographic importance being trifling, their absence will in that respect be immaterial.

The dispersed manner in which many of the rocks geologically connected are here situated, has also necessarily led to some diffuseness; perhaps to some repetition: while the importance of many of the facts has frequently compelled me to enter into general statements, which, should they appear superfluous to some, seemed absolutely required for the purpose of connecting the phenomena in an intelligible manner; as well as for the elucidation of some prominent and unsettled points in geological science.

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* Sky, clouds, Scand. The Isle of mist of the Gaelic poet. The Highlanders, who look no further than their own language, derive it from Skianach, winged: an etymology unworthy of a comment.—See the Map of Sky.

A paper on this subject appeared in the 3d Vol. of the Geol. Trans.: of a partial nature, but corrected and enlarged by subsequent remarks. The importance of the subject has induced me to remodel the whole: with the advantage of a more intimate knowledge of the country, and on a plan consistent with that adopted respecting the other islands described in this work.

The extreme length of the island appears to be about forty-five miles, and that line, lying between Vaternish point and the point of Sleat, is not materially different from a mean length of its sides, considering it as a parallelogram. Its extreme breadth lies between Copnahow point and Ru na braddan, and may be taken at twenty-four miles; but a more correct general idea of its superficial dimensions will be formed by measuring nearly across the middle of the island, which will give a mean breadth of fifteen. The superficial content does not however correspond to these measurements, in consequence of the remarkable indentations of the coast; the sea entering on all sides in such a manner, that it is difficult to find a place five miles distant from the shore. Its boundary is almost every where rocky and elevated; often rising into cliffs of great altitude, no less remarkable for their picturesque forms than valuable to the geologist for the display which they afford of the interior structure of the island.

The surface of Sky is almost invariably hilly, presenting three distinct assemblages of mountains separated by intervening tracts of high and undulating land: the plain of Kilmuir and a small tract near Loch Bracadale are the only exceptions. As these differences of exterior character are generally accompanied by changes of the component rocks, I shall, in describing the several divisions, slightly notice the prevailing substances, preparatory to the more minute details into which it will afterwards be necessary to enter.

Commencing with the southern division, a continuous ridge is found extending from the point of Sleat to Loch in Daal, where it suddenly subsides into a low tract stretching northwards towards Broadford. The general elevation of this ridge may be estimated at twelve hundred feet, or more; and it may be considered as continuous in the centre; being nevertheless irregular, and containing sinuosities, rather than valleys, which conduct its waters in small streams into the sea on each side. Almost the only wood that grows on the island is found in this district; the ash flourishing on both declivities of the promontory wherever the course of a stream through some small valley or ravine affords it shelter; and occupying, together with birch and alder, (the trees most congenial to these islands,) larger tracts on the western side near Ord, where the perishing remains of a wood once considerable are to be seen.

The flat tract above mentioned, into which the ridge of Sleat subsides, extends but for a short space in the same direction, which is north-easterly; rising again quickly into a second and more elevated ridge consisting of five united mountains; and thus intersecting the otherwise continuous high land of the south-eastern shore, by one deep indentation. On the eastern sides, these mountains descend by rapid declivities into the sea; while, on the western, they subside more gently into a low and narrow tract that extends from Broadford to Kylehaken. The elevation of this group does not appear to fall short of 2000 feet, and it is conspicuous among the hills of Sky, not less from its actual height and mass, than from the low tract by which it is insulated from the surrounding country. Notwithstanding the interruption here mentioned, these hills must be considered as forming a part of the ridge of Sleat, since their component rocks are not only similar, but are disposed with an unaltered continuity of direction.

The prevailing rocks of the whole ridge from the point of Sleat to the Kyle rich,* are, red sandstone, argillaceous schist, and quartz rock, accompanied by a body of gneiss and by other substances of which the details must be referred to the geological description.

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* The swift strait—a very expressive term: incorrectly, though generally, Kyle rea.

The ridge thus described is separated from the next elevated land to the north-west, by an irregular low tract forming a valley parallel to it and extending from the head of Loch Eishort towards the northern shore between Kylehaken and Broadford. A second irregular ridge succeeds to this, occupying the whole space from Swishnish point to Broadford and beyond it; and followed by another parallel valley, that of Strath, but little elevated above the two seas which it here separates. With some interference from syenite, the whole valley of Strath consists of limestone, the peculiarities of which, like those of the rocks before mentioned, must be referred to the geological description.

Thus far, Sky is found to consist of regular stratified rocks, which, whether primary or secondary, are extended in a line of which the prevailing tendency is north-east. But here all regularity ceases, and although some detached portions of the same and of other strata are to be found in several places, the remaining mass of the island must be considered as formed of unstratified rocks; all belonging to the family of trap, (including under that term syenite,) and, though of various external forms and characters, all incumbent on the strata and of posterior date. With the regularity of the rocks, that of the hills and valleys ceases; although there remain certain leading features to facilitate the division and description of the remaining tracts.

The most conspicuous part of the island is that which follows next from Strath to the northward, and consists of a confused assemblage of mountains of different external features, definable by two irregular lines drawn from the head of Loch Slapin to near Broadford on one side, and from Loch Brittle to Loch Sligachan on the other. There is no measurement of the height of any individual of this group; and unfortunately the general state of the weather in this stormy island has hitherto prevented me from supplying that defect.* An estimate must for the present be substituted; and it will not be far from the truth if the altitude be taken as ranging from 2000 to 3000 feet; the lowest apparently not falling short of the former, and the highest probably not exceeding the latter elevation. As the names of the principal hills appear in the map, it is unnecessary to enumerate them, unless where the circumstances occurring in any individual require particular notice, since they are all associated by two or three leading characters.

This group is divided into two portions, intimately united, yet characterized by striking differences in their external outlines and general features; circumstances arising from differences of composition, although both divisions equally appertain to the trap family. These external features are accompanied by a remarkable difference of colour, which, together with the strong contrast of their respective outlines, forcibly attracts the attention of a spectator on arriving in this island.

By far the larger portion presents a set of tame and generally rounded outlines, particularly unpleasing to the eye; the hills that form it being all separated from each other, and all equally characterized by the smooth and blunt conoidal shape; not a single projection appearing to break the uniform line they make on the sky, and their surfaces being equally devoid of the variety arising from bold crags or deep recesses. To add to the generally unpleasing effect, they often arise at once from the low grounds, without that variety of gradation and of complicated subsidence into lower ranges, which, even in hills of tame outlines, often produce forms not deficient in beauty.

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* When the reader is told that I made seven attempts and in five successive summers to ascend the Cuchullin hills, he will form some notion of the nature of the climate and will perhaps receive this as a sufficient apology. Sky is however exempt from the durable snows which during the winter cover the adjoining mainland. Asking a young female who was weeding some wretched potatoes in Loch Hourn, when the snow dissolved, the answer was "It never gangs till the rain comes" —such is the alternative.

The cause of the peculiarities now described is to be found in the facility with which they are disintegrated by atmospheric action, whence their outlines necessarily assume these characters; while the loose stones, by their constant descent from the summits, obscure the rocky surface, covering the sides with long torrents of red rubbish even more unpleasing to the sight than their conoidal forms. That red colour is indeed one of the most striking features of these hills, and although not universally prevalent among them, it occupies by far the larger space; while its superior conspicuity increases its apparent extent. It will hereafter be seen, that this effect arises from the syenite of which these hills are principally composed, which, on decomposition, suffering the pyrites it contains to rust, acquires the colour in question; while the frequent renewal of the fallen materials prevents the accumulation of vegetable soil or covering. To distinguish this part of the group, I shall give them the general title of the Red hills, as it will often be necessary to speak of them collectively; while they are, by this circumstance, as strongly as by their outline, contrasted with the other portion, the colour of which is dark.

The darkness of that mass is indeed extraordinary, and adds much to the wildness of aspect and grandeur of effect produced by the rugged and bold outlines of the mountains of which it is formed. No light seems to harmonize their colour to its place in the general landscape: perpetual shadow appears to cover them in every state of the atmosphere, and when the clouds involve their summits, a deep and dark abyss seems opened beneath into which the eye vainly endeavours to penetrate. Their exterior outline is equally remarkable, as well for the contrast it presents to the tame and smooth boundary of the Red hills, as for its peculiarly rugged and serrated form. Pinnacles and projecting crags darkly indenting the sky rise along the whole line, marking by their acuteness and permanence the durability of the rock of which they are composed, and indicating to the mineralogist a difference of composition between these and the neighbouring mountains which on a nearer examination he finds actually to exist. These differences will be the subjects of future discussion, but I may add that nothing more forcibly strikes the spectator in contemplating these mountains than this unequal durability of the two portions into which they are thus divided.

The chief part of the dark group consists of the Cuchullin hills. These form a curved ridge, rising from the shores of Loch Brittle and the sound of Soa with a rapid and rocky ascent; being obscurely divided into six summits, and the whole terminating towards the east in an almost continued precipitous face deeply furrowed by torrents. Some lower, but equally rocky hills, of similar composition and character, unite with them to enclose the lake Coruisk; while Blaven, forming a long acute ridge in a position still more easterly, rises above the whole; constituting the highest mountain in the island, and completing, with its bare and rocky surface, this dark and rugged mass.

To the northward of this group, on the western side of the island, the land continues high and hilly, but is no longer mountainous; its general elevation lying between 600 and 1000 feet, and its undulating surface being almost every where covered by brown heath, so as to present a dreary uninteresting appearance. The green pastures of Loch Brittle and Loch Eynort, the little valley of Talisker, and the low, open, and cultivated tract of Bracadale, form the only considerable exceptions to this general character. I may however add that the promontory to the west of Dunvegan appears to rise into hills somewhat higher than the general elevations above mentioned; the two flat topped eminences called Macleod's tables being conspicuous at a distance, not less from their resemblance to each other, than from the peculiarity of their outlines.

There is little throughout all this range of the interior country to attract the attention of the painter. If the distant outline is often grand or picturesque, the want of objects in the middle ground leaves the landscape barren, naked, and meagre: the artist searches in vain amid the wearisome repetition of brown, smooth, undulating moor, for the dark wood, the bushy ravine, the rocky torrent, or the intricacy of broken hills, to contrast with the distance and to fill his picture. The beautiful columnar range of great Brishmeal, above Talisker, is almost the only object throughout the whole tract capable of soliciting his attention.

The general character now given is that of the whole country as far as the line that joins Portree to Loch Snizort; a tract as uninteresting to the geologist as to the painter, since it presents him nothing but a perpetual recurrence of trap rocks in their most common forms.

The north-eastern portion of the island, comprising the district of Trotternish, offers more variety and interest. A long ridge, commencing at Portree, stretches away to the point of Aird; being elevated towards the middle into mountainous eminences, which, rising by a gradual acclivity from the west, terminate to the eastward in a rapid descent; often displaying precipitous faces of great extent, attended by circumstances of considerable grandeur and picturesque beauty. The greatest altitude of this ridge may be estimated at 2000 feet, and the highest point, the Storr, is at the same time the most picturesque. Here, the summit of the mountain is cut down in a vertical face, four or five hundred feet in height; while the steep declivity below is covered with huge masses of detached rock, the more durable remains of the cliffs above, now separated from that precipice of which they once formed a part. These are combined in a variety of intricate groups; while their massy bulk and their squared and pinnacled outlines present vague forms of castles and towers; resembling, when dimly seen through the driving clouds, the combinations of an ideal and supernatural architecture. The most remarkable of these rocks is said to be 160 feet in height, and, with the form, it emulates at a distance the aspect of a spire, presenting from afar a sea-mark well known to mariners.*

The remainder of this ridge exhibits other abrupt faces of rock not void of picturesque effect, but so much resembling in general character the more interesting shore scenery in which the island abounds, that it is unnecessary to describe them. Near Duntulm however, as well as towards Loch Staffin, the rocks assume the columnar disposition; and their long ranges, here rising above each other in distant succession, combined with the masses of hill which they crown, produce scenes of great variety and of powerful effect, if not strictly amenable to the rules of picturesque composition. On the western side of Trotternish the plain of Kilmuir presents the largest continuous tract of arable ground in Sky, emphatically called the granary of the island; while the deep indentation of Loch Uig, surrounded by a double line of cottages rising in two tiers upwards from the sea, each with its equal allotment of land, affords one of the most singular spectacles in rural economy, that of a city of farms.

As it is chiefly on the long extended and sinuous shores of this island that the geologist will find those details in which he is most interested, so it is there that the admirer of picturesque beauty will meet with the most frequent subjects of his pursuit. For both these reasons

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* Had this rock been in the plains of Hindostan instead of the mountains of Sky it would have been an object of greater devotion than the Jaggernaut Pagoda. The Gaelic name of this Lingam does not admit of translation. See the plate.

I shall now therefore trace the line of the coast, of which the leading features would otherwise be passed over in silence; since, through a large space, the identical nature of the rocks will prevent any description of them from being required in the geological investigation.

The promontory of Strathaird, from which this description commences, is low at its extremity, being there formed of those stratified rocks which constitute a portion of the adjoining shores of Loch Eishort, but it rises gradually towards Blaven by a succession of hills of trap presenting no remarkable features. It is for the most part surrounded by cliffs, rarely exceeding sixty or seventy feet in height, and cut smoothly down so as to afford a perfect display of the succession of the strata of which they are composed. On the eastern side these are remarkable for the very extraordinary number of caves they contain, and for the fissures by which they are intersected. These are rarely of any great dimensions, but are so numerous that they sometimes occupy nearly as much space in a given distance as the solid parts of the cliffs themselves. Twenty or thirty are sometimes found in the course of a few hundred yards, the interstices having a resemblance to the ends of detached walls placed in a parallel manner. They are the consequences of trap veins which have been washed away, but as they present important geological facts, they will be described more particularly hereafter.

Few of these caves have been explored, but one has acquired historic celebrity from its having been among the numerous places of temporary refuge inhabited by Prince Charles during his concealment. Another has recently become the cause of great resort to Sky on account of its stalactitic concretions, being popularly distinguished by the name of the Spar Cave: it lies on the estate of Mr. Macalister, and is too well known to require any more accurate description of its locality. This cave is accessible from the cliffs above, for a short time only, at low water; but by means of a boat it may be visited at any time in moderate weather, or with the wind off the shore. The entrance is little less striking than the interior, and to the admirer of the picturesque it presents a scene even more attractive. This is formed by a fissure in the cliff, extending for a considerable way and bounded on each side by high and parallel walls, its gloom being partially illuminated by reflected light, and its silence scarcely disturbed by the wash of the surf without. A narrow and obstructed opening leads unexpectedly into the cave, which for a distance of about an hundred feet is dark, wet, and dreary. A steep acclivity formed of a white stalagmite then occurs, which being surmounted with some difficulty, the whole interior comes into view, covered with stalactites disposed in all the grotesque forms which these incrustations so commonly assume. Lively imaginations may here indulge in the discovery of fanciful resemblances, and the concretions have accordingly received names more descriptive of the fancies of the spectators than of their real forms. The dimensions of the fissure are in this place but inconsiderable, the breadth not being more than ten feet, and the height scarcely exceeding twelve. Here however the latter suddenly rises to forty feet or more, the surface of the stalagmitic and cascade-like mount which divides the sparry from the dark part of the fissure, conducting by a declivity of about thirty feet in length, to a pool of water that occupies a space of twelve or fifteen feet, and divides the whole into an outer and inner portion. The dimensions are here somewhat enlarged, and the height in particular becomes much more considerable. At a distance of about fifteen or twenty feet more from the pool, the stalactitical ornaments cease, and shortly after the cave terminates; the whole length from the entrance to the extremity being about two hundred and fifty feet. However beautiful the interior of this cave may be, from the white colour and ornamental effect of the stalactites which incrust it, the want of sufficient dimensions materially lessens the interest which in all other respects it is calculated to excite. At the termination of the stalactitical ornaments there is a dark descent for a few yards, filled with rubbish from the ruins of the roof above, which being here naked as well as accessible, is plainly seen to be one of the trap veins. This vein is here about ten feet wide, which is the general breadth of the cave itself, and it is easy to see how by the wearing out of its substance the excavation has been formed, having subsequently acquired its present degree of ornament by the infiltration of carbonate of lime. Considering the great depth of this cave and its present distance from the sea, we are inclined to inquire by what means so extensive an excavation could have been formed, and how the rock which has fallen from it has been removed.. It is probable that the depth of water at the face of the cliffs was once such as to permit the ready access of the sea to them, and that at this period the excavations so numerous on this shore were produced. The subsequent accumulation of rubbish formed by its action, has in later times produced the slope or shore which now excludes it from further access and protects the cliffs from further demolition.

In the excavations which are found in the floor of this cave we have the means of seeing the process by which calcareous spar is formed, the crystallization being carried on in a solution of the carbonate of lime, precisely as it is in the saline solutions in our laboratories. All these small pools are filled with groups of crystals, in a state of constant augmentation, and all of them, however accumulated, displaying the primitive rhomb. Doubtless, these forms must be affected by the agitation which the falling drops occasion in the solution; and it is in all probability owing to some circumstances of this nature, constant in the same spot but varying in different situations, that crystals of one form are found to affect certain places, while in others they regularly assume some other modification. As this cave offers no other novelty to the mineralogist, and belongs to a class of geological facts by no means uncommon, it is unnecessary to enter into any further details respecting it.

If we except the gloomy solitude of the mountain scenery at the head of Loch Slapin, the coast can scarcely be said to present any interest either throughout the remainder of this inlet or the adjoining one of Loch Eishort; the land descending almost every where without cliffs to the sea, and, except about Ord and Dunscaich, being scarcely varied by the adventitious circumstances of scattered wood or ornamental cultivation. From these points the distant views towards the north-west are nevertheless grand and striking, including the wide expanse of the sea, bounded on one side by the contrasted forms of the Sky mountains, and on the other by the more distant hills of Rum.

There is but little interest or beauty during the remaining part of the circuit round Sleat till we arrive at the narrow sound that separates it from Glen Elg, if we except the prospect of the opposite shore, formed by the wild and lofty mountains of Loch Hourn and Loch Nevish. The land in this strait rises high, and generally with a rapid acclivity, displaying broken rocks interspersed with coppices and brushwood and enlivened by innumerable torrents, which together with the proximity of the sides, the rapidity of the tide, and the quick succession of objects, all conspire to excite an interest which is preserved till we arrive at the wide bay that forms the entrance of Loch Duich. Here, the variety of the coast line, the wide but intricate expanse of water, the scattered rocks, the picturesque and various outlines of the mountains of Sky itself and of the mainland, with the ruins of Kylehaken Castle, its rising town, and the bustle of the shipping that frequents this sea, combine to produce scenery scarcely exceeded on the western coast. But here again all beauty once more vanishes.

as the open channel appears, besprinkled it is true by islands and backed by mountains, but the former being without intricacy as the latter are without grandeur.

The character of the coast continues equally uninteresting to Portree, but from this place northwards to Loch Staffin a long and almost unindented line of shore extends, unlike the greater part of the island, since it offers no refuge for ships; not even a cove or a flat shore existing where a boat can be drawn up. At a distance, the whole line presents an uninterrupted wall of high cliffs rising in successive stages above each other; the mural face of each being surmounted by a green terrace, sometimes terminating in the sea, at others skirted by a slope of huge fragments interspersed with verdure. On a nearer examination a greater variety is found; the high cliffs, which appeared to overhang the water, often retiring into the interior, while the nearest present more moderate elevations, and in one or two places disappear altogether; a gentle descent leading down from the interior precipices to its edge. The high and rugged summit of the Storr, with its lofty precipitous face and the pyramids which cover its declivity, towers above all; giving the central feature and leading character to the whole scene and stretching away into the long ridge of mountain land that crowns this line of rock.

In general the high cliffs of this shore present such a continued uniformity of character, that the impression of grandeur and simplicity produced by the first aspect of their continuous, even, and lofty, faces, is lost by frequent repetition; the high cascade of Holme being almost the only feature to vary the scene between Portree and Ru na braddan. Beyond this point a series of columnar cliffs commences, stretching away to Loch Staffin and presenting the general features of the ranges of Staffa, but on a scale of five or six times the magnitude. Although the columns are not so accurately formed nor so distinctly marked as in that island, their effect at the proper point of sight is equally regular; while from the frequent occurrence of groups, recesses, and projecting masses, and from the absence of any superincumbent load, they are far superior in lightness of appearance as well as in elegance and variety of outline. In many cases, where the columnar trap lies above the horizontal strata, the appearance of architectural imitation is much more perfect than in any part of Staffa; the stratified rocks presenting horizontal courses of natural masonry, resembling basements, crowned by straight or curved colonnades; one of which, from a particular point of view, so exactly represents the general proportions and character of a circular temple of Greek architecture, that the artist who should represent it truly would be suspected of forcing nature into the forms established by art. A singular circumstance sometimes occurs among these columnar ranges, adding much to the lightness and elegance of their effect. This is the detached state in which slender groups or single pillars remain after the surrounding parts have fallen away. From this mode of wasting, the summits of the cliffs are sometimes crowned with pinnacles, or with conoidal points resembling those of the latest style of Gothic architecture: while in a few instances, single columns or groups are seen standing detached before the colonnade as if they were the last remains of some ruined portico. One of the most remarkable appears to be about 200 feet in height; its lower part being clustered, and the pillars terminating in succession upwards till a single one remains standing alone for a height of thirty or forty feet, and apparently not above four or five in diameter. In another place a group of five or six, adhering together laterally, stands advanced in face of the cliff, presenting its narrowest edge against the sky and reaching to fifty or sixty feet in height. A similar detached column, but of far less height, is seen in the small island of Trodda, and another of still inferior dimensions on the shore to the south of Duntulm Castle.

At Loch Staffin the hills in the interior rise with great magnificence to the height of 1000 and of 1500 feet, enclosing a large sweeping valley. The long columnar ranges already mentioned which crown their summits, increasing in elevation as they retire in succession, assist with the cliffs below that present the same regularity, in producing a variety of scenery to which that of all the basaltic islands must yield in magnificence and extent, however it may sometimes exceed in simplicity and grandeur of effect.

I must not, in quitting this shore, omit to notice a second cascade which, if not of equal magnitude with that of Holme, is still very striking from the simple and unbroken manner in which it falls over a columnar and vertical cliff not less than 300 feet in height. There can be nothing picturesque in such a disposition of parts, but there is an effect produced by the total absence of all accompaniments which from its novelty and simplicity is very striking. When the squalls, which blow from the high lands in this stormy region, descend so that the sea rises in smoke beneath them like the vapour from a cauldron, but little of this stream reaches the waves below.

The columnar forms continue for some way round the point of Aird into Loch Snizort, where the ruins of Duntulm Castle serve to give interest to dimensions now far contracted in altitude and in extent of sweep. But at a point not far to the southward of that ruin, is a small promontory presenting a resemblance to some parts of Staffa, and on a scale sufficient for grandeur, to an eye not previously satiated with the overpowering vastness of the eastern coast. Had Staffa remained unknown, this spot might have acquired the celebrity which has been exclusively reserved for that beautiful yet not singular display of columnar scenery. It will be rendering an acceptable service to the admirers of that island to point out an object hitherto unknown, which, with some variety of disposition and effect, is not unworthy to rank with it among the attractive scenes of these interesting shores. Three caves occupy the front of this promontory, being formed, like those of the large cave of Staffa, among the columns; and presenting, although on a smaller scale, the same general effect of architectural order. A sharp contrary sea, produced by the stream of tide running round the point, prevented me from entering them; an attempt to be made only in smooth water and fine weather; I cannot therefore give any account of their interior dimensions or arrangement. Their height appeared to the eye to range from fifteen feet to thirty, the highest being the most northerly, and the total height of the promontory being about sixty feet.*

Beyond this point occur the rich flattish tract and the low shores of Kilmuir, no further objects of interest appearing along the remaining coast of Trotternish, if we except Loch Uig, formerly mentioned.

The shores of Vaternish on both sides appear to be equally void of interest, consisting of a succession of vertical cliffs alternating with occasional low shores, and productive of scenery which, however striking on a first view or when occurring sparingly, becomes monotonous from its identity and tiresome from its repetition. I must not however pass Loch Follart without pointing out the beauty of the views over its wide expanse sprinkled with islands; enhanced by the interest derived from the picturesque aspect of Dunvegan Castle.†

The coast from Dunvegan head to Loch Brittle is, with few exceptions, formed of high cliffs; variable in their altitudes as in their abruptness, but generally very lofty; often indeed precipitous and even perpendicular from their summits to the water's edge.

Between that promontory and Loch Bracadale they are often also perpendicular, but variable in height, seldom attaining the great elevation which they reach between Talisker and Loch Eynort. They often present a singularly striped appearance, from the great variety of colours in the several beds which compose them; of which twelve or more may in different places be counted, all horizontal and tolerably equal in their dimensions. The forms of these cliffs are far too monotonous and too square to afford subjects for the pencil, every part being marked by a general similarity of character. Near the entrance of Loch Bracadale some variety is presented by the three detached and pyramidal rocks called Macleod's Maidens, the highest of which appears to reach to about 200 feet.* Such detached pyramidal masses are of frequent occurrence on this coast, a remarkable perforated one being seen in Loch Bracadale, and a similar one not far from Loch Eynort. They are, like all other objects out of the ordinary course of nature, rather singular than picturesque: the strange and the bizarre are seldom legitimate subjects for painting, and rarely please long, after the first wonder has subsided.

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* Plate IV.

† Plate

Some caves are found in Loch Bracadale but they have no particular claims on notice, either from their beauty, their magnitude, or their singularity. Similar caves are of frequent occurrence between Talisker and Loch Brittle; the low projecting rocks being also often perforated by arches which are sometimes exceedingly complicated and remarkable. With the exception of some projecting points of high rock, the shores of Loch Bracadale are flat, this tract being also one of the most fertile spots in Sky. At its southern extremity the cliffs are perfectly vertical, and without that slope at the foot which so commonly accompanies the high cliffs of trap and are so conspicuous in some places on the eastern side of the island. The retired and green valley of Talisker opens to the sea by a low beach, on which a natural embankment has been formed by the western swell. Here the cliffs again become high, and shortly rise to the greatest altitude which they attain along the whole line of this coast. In a general sense they may be called perpendicular, but they are seldom without grassy slopes, either at their feet or in some intermediate parts, which diminish their vertical appearance when seen in profile, although when viewed in front they still appear perpendicular. The outline is here more varied, the parts more numerous and intricate, and the tones of colour more agreeable; while the foregrounds, which are formed by some high and conspicuous detached rocks, assist in producing some of the most magnificent compositions of rock scenery that are to be seen on the coasts of Sky. Not far from this place is a large and very remarkable slide, by which a considerable portion of the cliff has been brought from the summit down to the shore, where it forms a promontory obstructing the further progress of the mineralogist who in defiance of toil and hazard pursues along this rocky coast the beautiful minerals in which it abounds. The heights of these cliffs are considerable. Comparing them with the masts of passing ships they do not seem to be much less than 800 feet. The cascades which fall over them are often dissipated in spray before they reach the ground, or descend in a shower of drizzling rain.

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* Plate III.

The cliffs continue with more variety of height than of character to Loch Brittle, the habitation of the Osprey, and of some rare minerals more interesting to geologists. At this Loch the land runs out into low projecting points, the interior being of small elevation and disposed in terraces. The cliffs rise but little from this place to the entrance of Loch Scavig, where the coast assumes a new character, the declivities of the hills reaching the sea at a considerable angle, and without intervening cliffs.

The scenes which here occur are as remarkable for their difference of character from the preceding, as for their grandeur; nor must they be passed without notice, though it is impossible to convey any idea of this spot, which before my visit had never been seen by a stranger, and was indeed known to few even of the inhabitants of Sky. Scarcely any but the shepherds had trod these sequestered retreats, the dwelling of clouds and solitude; fit haunts for the poetical dæmons of the storm.*

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* I have on a former occasion described the nautical circumstances under which I did not reach Barra Head: it will not be useless to describe those under which I accomplished a first visit to Loch Scavig. The itinerary of a traveller is often of advantage to his successors, while a single anecdote is often more characteristic of a people than a laboured description.

The expedition was to proceed from Gillan on the west side of Sleat, and as a Highland boat is not soon set in motion, the crew was bespoke on the preceding evening. It was in vain that the orders were given for six in the morning, the men were not collected till nine, a Highlander being seldom ready, even for his harvest field, before ten o'clock. After the ordinary useless discussions we proceeded to the beach, but the tide had ebbed and the boat was dry: it could not be launched without further assistance. Before the requisite assistance was procured an hour had elapsed. Being at length launched, it was discovered, that out of the four oars required, only one was present. It was necessary to procure the complement from a neighbouring village, and this was scarcely accomplished in another hour. Some hopes at last appeared that the day would not elapse in preparations, but of the pins required for rowing, only two could be found, swimming in the water which filled half of the boat. Sky not being a land of wood, some time passed before this little but indispensable requisite could be obtained, for which the teeth of a harrow were at length procured. We were now fortunately under way, the first stroke of the oars had been given, when an unlucky breeze springing up, one of the crew proposed that we should return for a sail. It was in vain to oppose this motion, too favourable to the natural indolence of this people, although it was not easy to conjecture how a sail was to be rigged on a boat which had neither step for a mast nor provision for a rudder. It was wrong to wonder at the latter defect, as the use of this contrivance is quite unknown in many parts of these islands. In less than two hours the trunk of a birch tree was procured, which, being fastened to one of the thwarts with some twine, was converted into a mast worthy of the first navigator. A broomstick, secured to

Loch Scavig is inaccessible by land on the north side, and equally so on the south to all but the active and practised mountaineer. The traveller, whose object is picturesque beauty, should enter it from Strathaird. In this direction the view from sea is extremely fine, the dark ridge of the Cuchullin, with all its spiry and serrated projections, flanked by the equally dark and lofty ridge of Blaven, forming a varied and rugged outline on the sky. On entering the bay these summits disappear as they retire below the high skirts of the hills, which descend into the sea varied by projecting points and rocky islets, and surrounding the spectator with a continuous surface of bare and brown rock scarcely presenting a symptom of vegetation. The falling of a cascade, the deep dark green of the water, and the wheeling flight of the sea birds that frequent this retired spot, are the only objects which vary the uniformity of colour and of character it every where displays. On landing, similar scenes meet the eye in every direction, no intruding object occurring to diminish the effect produced by the gloomy grandeur and savage aspect of the place.

Passing the river which runs foaming over a sheet of

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this mast in a similar manner, formed the yard, and the sail was composed of a pair of blankets pinned together by wooden skewers and fastened to the broomstick by the same means. The want of sheet and tack was supplied by a pair of scarlet garters which one of the men stripped from his chequered stocking, and thus a ship was at length generated, not much unlike those of the heroic ages of which memorials are still existing in the sculptures of Iona. It was two o'clock before this rigging was perfected and we were ready for sea.

The want of a rudder being supplied by an oar, and the sail unable to stand near the wind, we made no way except to leeward, and there was a prospect of reaching Rum instead of Scavig; neither arguments nor authority being of the least avail with a people who, in spite of their practice, are utterly ignorant of the properties and management of a boat. On a sudden a fortunate squall unshipped the helm, brought the sail aback, and the whole apparatus, too feeble to upset the boat, was carried overboard. We reached our destination when we should have been returning, and passed the greater part of the night at sea.

smooth rock into the sea, a long valley suddenly opens on the view, enclosing the beautiful lake Coruisk, on the black surface of which a few islands covered with grass appear with the vividness of emeralds amid the total absence of vegetable green. On every side the bare rocky acclivities of the mountains rise around, their serrated edges darkly projected on the blue sky or entangled in the clouds which so often hover over this region of silence and repose. At all seasons and at all times of the day darkness seems to rest on its further extremity: a gloom in which the eye, discerning but obscurely the forms of objects, pictures to itself imaginary recesses and a distance still unterminated. A remarkable contrast is hence produced in viewing alternately the two extremities from any central point. The entrance, less obstructed by mountains, presents the effect of morning rising to illuminate the depths of the opposite extremity, which appears as if perpetually involved in the shadows of night.* Silence and solitude seem for ever to reign amid the fearful stillness and the absolute vacuity around: at every moment the spectator is inclined to hush his footsteps and suspend his breath to listen for some sound which may recall the idea of life or of motion. If the fall of a cascade is by chance heard, it but serves by its faint and interrupted noise to remind him of its distance, and of the magnitude of the mountain boundary; which, though comprehended by a glance of the eye, and as if within reach of the hand, is every where too remote to betray the course of the torrent.

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* It is not surprising that Coruisk should be considered by the natives as the haunt of the water goblin or of spirits still more dreadful. A seaman, and a bold one, whom on one occasion I had left in charge of the boat, became so much terrified at finding himself alone, that he ran off to join his comrades, leaving it moored to the rock though in danger of being destroyed by the surge. I afterwards overheard much discussion on the courage of the "Southron" in making the circuit of the valley unattended. Not returning till it was nearly dark, it was concluded that he had fallen into the fangs of the Kelpie.

The effect of simplicity and proportion in diminishing the magnitude of objects is here distinctly felt, as it is in the greater efforts of architecture: those who have seen the interior of York Cathedral will understand the allusion. The length of the valley is nearly four miles, and its breadth about one; while the mountains that enclose it, rise with an acclivity so great, that the spectator situated at their base views all their summits around him; casting his eye over the continuous plane of their sides, as they extend upwards in solid beds of rock for nearly a mile and present a barrier over which there is no egress. Yet on entering it he will probably imagine it a mile in length, and fancy the lake, which occupies nearly the whole, reduced to the dimension of a few hundred yards. It is not till he has advanced for a mile or more, and finds the boundary still retiring before him unchanged, and his distant companions becoming invisible, that he discovers his error, and the whole force and effect of the scene becomes impressed on his mind. He who would paint Coruisk must combine with the powers of the landscape-painter those of the poet: it is to the imagination, not to the eye that his efforts must be directed.

From the general description of the face of the island, its condition in an agricultural view will be readily collected. The almost absolute want of trees immediately attracts attention; since the form of the land, often affording sheltered situations, is favourable to their growth; while its small value for other purposes removes one of the obstacles to planting; a branch of rural economy that would also be much aided by the facility so often here afforded for enclosing large tracts at a small expense.

With the exception of Bracadale, some parts of Trotternish and of Sleat, and a few smaller portions at Broadford, Snizort, Portree, and other places which I need not enumerate, there is no land in cultivation; the greater part of the island being occupied by a system of pasturage almost limited to the production of black cattle. I need offer no remarks on its agriculture after those which have been already made in describing the other islands: I may only notice generally, that a certain tendency to improvement has been manifested within a few years; the ancient possessions in joint tenure having nearly disappeared in the ameliorated system of separate farms; while the division of the land into larger lots, and the accumulation of capital still required to produce permanent and extensive improvement, remain for future exertions and more favourable circumstances.

Although the greater part of the pasture of the island consists of moor land covered with heath and grasses of little value, many tracts of green herbage are to be seen, of which those about Loch Eynort and Trotternish are the most conspicuous. It is often difficult to determine the causes of these differences in the natural produce of a given soil, where many are necessarily engaged in producing the effect. As far as its composition alone is concerned, the pursuits of the geologist are in some measure calculated to throw light on the subject. Yet even where an apparent identity exists in those rocks from the decomposition of which any soil is formed, there are often differences in the results that seem to elude all explanation. Sky presents some remarkable instances of this nature which it will not be irrelevant to point out in a cursory manner.

It is already well known that many of the rocks of the trap family, like some lavas, afford on decomposition one of the most fertile soils with which we are acquainted. I have mentioned this fact on other occasions, and noticed at the same time the great differences which appeared in this respect in different situations where there was nevertheless a considerable resemblance in the rocky substratum. The different proportions of calcareous earth, of alkali, and of carbon, which latter appears to be an ingredient in some traps, are probably the circumstances that constitute the chief differences in this case; but with this we must also recollect that the various rocks of this class differ in composition in perhaps a greater degree than any others with which we are acquainted, and that, together with this essential variation in their composition, they also possess infinite varieties in hardness, and in the property of decomposing by the action of air and water. Many considerations must therefore enter into our views before we can decide on the fertility of the resulting soil, unless that be actually exhibited in those places where decomposition has already taken place.

Although the mineralogist can often trace no difference among the trap rocks which occupy many parts of this island, yet the greatest differences in the produce of the soil incumbent on them will be found to exist; the one displaying little but heath, rushes, and the other inhabitants of moor lands, while others are covered with a dense mat of verdure. In many cases, doubtless, the varieties of exposure, drainage, or declivity, will account for these differences of effect, yet similar differences occur even where these circumstances are in both cases identical. It is evident, that, independently of variations in the chemical composition of the subjacent rocks, the incumbent soils will differ according to the greater or less facility with which they undergo decomposition. Where that takes place to a considerable extent, the soil is commonly not only deep but fertile, and will often be found covered with green pasture, as on the eastern side of Trotternish and on the hills that surround Loch Eynort. There are cases nevertheless where a deep decomposition of the rock is to be seen, while the ground is still covered with peat and productive of little else than heath. This decomposition is occasionally so complete that in many places the rock, while it appears to retain its solidity with its form, can be cut through with a spade, and thus readily moulders into soil as soon as it is exposed to the effect of the rains or to mechanical force. The chief obstacle to this ultimate change must be sought in the covering of peat which invests the soil. This substance, scarcely pervious to moisture, prevents that access of rain which, united with frost, might perfect an incipient decomposition; while, remaining for ages undisturbed, it also serves to conceal that which only requires exposure to become useful. An obvious improvement is thus suggested, namely, the exposure of the subjacent rock by the plough or *caschrom;* which in many cases, where the peaty surface is thin, is sufficient to generate at once a permanently fertile soil by mixing the carbonaceous matter of the surface with the earth that lies beneath; a labour, in most cases, sooner or later recompensed by its effect in admitting the access of air and water, even where the rock is not actually mouldered. Such experiments must, of course, as in all other cases, be resolved into mere questions of expense; but there are few where, if that can be tolerated, the certainty of the result is greater.

Another remarkable anomaly of this nature exists in the calcareous district of Strath already described, presenting a difficulty of which there is no other apparent solution. The general fertility of calcareous soils is sufficiently notorious, and, in conformity to that rule, the existence of subjacent rocks of limestone can almost always be determined in the Highland mountains by the patch or stripe of brilliant verdure occurring in the brown waste. The district in question presents every variety of elevation, exposure, and drainage; yet, with a small exception occurring in the lower parts of the valley, the surface is boggy, brown, and barren; scarcely yielding in poverty of vegetation to the soils that lie on quartz rock, and, what is no less remarkable, almost every where unproductive of the well known plants which are the usual inhabitants of calcareous land. On similar declivities and in similar circumstances, Lismore, Glen Tilt, and other calcareous districts of Scotland, are covered with the most luxuriant verdure. If this difference of result be incidental, as it can scarcely fail of being, it may perhaps, as in the instances of trap above mentioned, be attributed to the covering of peat, accumulated in ancient times under the shade of a forest of which the traces may be found in the buried roots and fragments of trees. It is indifferent what soil or what rock lies under such a substance, since its influence cannot reach the surface; while, if the cause which I have here conjectured be the real one, it adds another striking instance of the necessity of human labour in aiding the efforts of nature even where these are most bountiful.

The last circumstance here worthy of notice respecting the connexion between the fundamental rock and the resulting soil, occurs in Sleat, towards the eastern coast. The rock here consists of gneiss, and, like the trap before described, is to be seen in many places completely decomposed for many feet in depth, without any sensible alteration of its appearance or form, and only waiting the touch of mechanical force to reduce it into powder. Wherever this has already occurred, the consequence is a yellow loam of an excellent quality, rendering this part of the country one of the most fertile in the island.

THE relics of ancient art still preserved in the Western islands, are in most cases so little interesting that there is not much inducement to treat of them in detail. I have in other places described a sufficient number to convey a general idea of their characters, and there is scarcely any thing in this island so particularly distinguished as to require a minute notice.

The most numerous ruins are those of the circular strengths commonly called Danish, many of which are found on different parts of the coast; but all, as usual, so far destroyed as to convey but a very slender notion of their original state. Various monumental stones are also found, of which those near Loch Uig are the most conspicuous, if indeed they are not of Druidical origin. Whatever their object has been, the repetition of antiquarian conjectures would here be much misplaced.

If there be any very ancient monuments in Sky at all distinguished from those of the other islands, it is the cairn on Ben na Caillich, visible at a great distance even on this elevated summit; its magnitude bespeaking the importance of the person or of the event in commemoration of which it was erected. I shall be excused from repeating the traditions respecting it, since they are unworthy of regard.

The more modern remains are not numerous, nor, with the exception of Dunvegan Castle, are they very remarkable. A small portion only of the castle of Knock is still standing to bespeak its importance, but it seems to have been merely a castellated mansion. Duntulm is more entire, and, with dimensions equally limited, displays some remains of architectural ornament; a circumstance extremely rare in the Highland castles, and seldom exhibited with much liberality even in the low country, where greater opulence must have prevailed and more taste might have been expected.

The very name of Dunscaich, the traditional residence of the "King of the Isle of Mist," will naturally excite interesting associations in the minds of those who are versant in Gaelic poetry. But its interest is limited to its poetic celebrity. The present building is of recent date, nor is much of it remaining. If that which may have existed only in song be worth a conjecture, the residence of Cuchullin may with greater probability be placed on the neighbouring rocky islet, where the ruins of an ancient circular fort are still to be seen. It is said that vitrified fragments have also been found in the same place: I had not the good fortune to discover any, though I searched with great care.*

CONSIDERING the magnitude of Sky and the variety of surface which it presents, its alluvial deposits are trifling, and, except in one instance, possessed of no interest. It will be easily collected from the map that the indentations which form the sea lochs are in some cases determined, as on the continental land, by the valleys that are interposed between the ridges of hills, and in this case they are also the aestuaries of the rivers. But many of them are merely sinuosities of the general boundary, receiving no streams of note. To the former belong the narrow Lochs Slapin, Scavig, Brittle, Harpart, Eynort, Eishort, Sligachan, and Portree; Lochs Bracadale, Follart, and Snizort, belong to the latter.

Although the elevation of the country is considerable, and the climate among the most rainy of this kingdom, Sky affords no rivers of any magnitude, their course being too short to admit of the accumulation of much water. The river which runs into Loch Sligachan carries more water to the sea than any other, and after it follow in order those which run into the Lochs Harpart, Slapin, Eishort, Bracadale, Portree, Snizort, and Broadford. The other streams are rivulets scarcely worthy of enumeration. The drainage of the whole country is determined by the positions of the hills and sea lochs, and may readily be collected from the preceding observations. There are three or four fresh-water lakes, but of small size, and, except those of Coruisk and Colmkill, hardly worthy of the name. The courses of the streams exhibit but small traces of the wasting of the land. Like other mountain torrents they occasionally bring down rubbish and stones, but these bear no proportion to the accumulations of loose matter so common on the mainland in similar situations, nor do they offer any example of transported materials of which the origin is not to be traced to some neighbouring rock.

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* I may here remark, that I have examined many vitrified forts since the period at which a paper on that subject was published in the Geological Transactions. The general conclusion that they were strong holds and vitrified by design, has been confirmed by these examinations. It may also be remarked, that where no trap rocks are found, the vitrifiable ingredient has proved to be hornblende schist or gneiss containing hornblende. The wooded state of the country in ancient times removes any difficulty supposed to arise from the want of fuel.

Commencing at Loch Slapin, a considerable alluvium may be observed occupying the head of this Loch and extending up Strathmore; encroaching on the top of the bay, and evidently formed by the waste of the Red hills, with additions comparatively insignificant from the naked precipices of Blaven.

As the upper end of Loch Eishort receives no river of note, it presents no alluvial deposit; and no further marks of waste, encroachment, or alteration of the sea line, are to be observed round the point of Sleat till we reach Loch Oransa. Partial depositions of gravel may be traced from hence round the shore to Kylehaken, where a considerable bank of alluvial matter is to be observed, of which I shall presently give a more particular description. The shoaling of the sound of Scalpa, now almost fordable at low water, appears to be the result of similar deposits influenced by the concurring action of the tides through that strait; and it will probably at some future day unite the two islands into one. The head of the eastern Loch Eynort is also the receptacle of a considerable deposition of rubbish brought down from the Red hills; a waste sufficiently great to alter the courses of the small streams which run through the narrow valleys that divide them. Similar, but more extensive accumulations from the same cause have formed a tract of plain ground at the head of Loch Sligachan, subject to frequent inroads and changes from the still varying course of the stream. The waste of that land which supplies the river running into Portree harbour, appears also to have had some effect in filling up its southern branch with a deposit which the ebb of the loch has no tendency to remove. From Conurdan to the northern point of the island, the high cliffs of trap occasionally exhibit the species of decomposition characteristic of these rocks, in the vast slopes which decline from them to the shore wherever the action of the tide has not been sufficient to prevent that accumulation. Continuing round the point of Ruhunish, similar deposits are occasionally found as far as Loch Snizort, at the end of which, as well as of Loch Uig, the same appearances of waste are visible. The parish of Kilmuir offers the only considerable tract of alluvial land in Sky, from which its superior and long established fertility is probably in some measure to be explained.

The shores of Loch Bracadale exhibit, when low, considerable portions of clayey alluvial soil, characterized, like those of Kilmuir, by extraordinary fertility. A similar alluvium may be observed at the head of Loch Harpart; and the little valley of Talisker appears to have been entirely gained from the sea at some distant period, by a combination of the waste of the land with the counteracting efforts of the western swell, which has thus, as formerly noticed, formed a natural embankment for its further protection.

A remarkable difference between the effects of the eastern and the western sea is to be seen along the western shore of the island from Dunvegan head to Loch Brittle. I already observed that the eastern cliffs were often covered by slopes of alluvial ground descending to the sea; but the western, though formed of the same rocks, offer an almost continued precipice, the foot of which is every where washed by a turbulent swell. These cliffs are in a state of daily ruin, and their bases are beset with enormous masses of rock which from time to time fall from them. The rocks called Macleod's Maidens, the islands in Loch Bracadale, and other detached rocks which skirt this coast, mark equally the gradual waste of the land. But no slope is formed against their faces, nor does any artificial shore accumulate at their feet, except a narrow interrupted stripe composed of fragments and almost impassable. The clay, sand, and smaller pieces are probably carried away from the coast far into the depths of the sea, by the incessant action of the western swell.

Near Kylehaken an alluvial deposit of greater importance occurs, occupying a space of about a mile on the shore, but not exceeding a few hundred yards in breadth; while it terminates on one side in the elevated ground, as it does in the sea on the other. It seems to be the remains of a plain formerly much more extensive, since its boundary towards the sea consists of a series of straight lines; the loose materials assuming the usual angle, and exhibiting precisely the same appearances which characterize the terraces that line the alluvial valleys through which active rivers have cut their way. The bar of Kylehaken harbour, and the gravelly soundings of this shore which render it an insecure anchorage, equally indicate an extent once more considerable, and confirm the supposition produced by its straight edge and the angle of its declivity. The surface is about sixty or seventy feet above the level of the sea.

No rivers at present flow in the vicinity of this plain, nor is there, from the form of the ground, any reason to suppose that they have ever flowed, so as to enable us to account for this deposit of loose materials. The substances are nevertheless rounded, and consist of those rocks which are seen in the neighbourhood, presenting a large proportion of the various hard sandstones, with some occasional pebbles of gneiss and of hornblende schist. It might perhaps be imagined that the ordinary fragments of the mountains which back this little plain, descending to the sea and there rolled, might have been rejected by the tides so as to form these banks; but this supposition is invalidated partly by the presence of gneiss and hornblende schist, which do not occur among these mountains, and partly by the altitude of the banks above the present high-water mark. It must doubtless be granted that if at some more ancient period the strait of Kylehaken was narrower than it now is, the same tide-wave which now passes through it would cause a much more considerable elevation of its tides. But it is already very narrow, and no possible contraction that can be imagined, would be sufficient to produce a difference of elevation so great as would be required for this purpose. It must be added to this difficulty, that the uniformly level surface of the plain is an insurmountable obstacle to this supposition.

In defect of any other solution, it can only be supposed that this is a fragment of some ancient diluvian deposit, instances of which, although very rare in the islands, are sufficiently abundant upon every part of the continent of Scotland. No estimate can be formed of its original extent, nor can any valid conjecture be offered of the mode in which it has been so abruptly cut down. It is however likely that although the present direction of the tides is such as not materially to exert any action on it, that direction may have varied in the progress of time, from alterations in the shape of the bottom of this very narrow channel, subjected four times in every day to the alternating action of a rapid stream; as well as from the probable removal of a similar alluvium from the opposite shore of the mainland. As we find analogous causes producing daily and visible changes of the same nature in the courses of rivers, the supposition is not incompatible with facts; since the narrowness of the Kylehaken channel and the rapidity of the tide, give it in this respect all the characters of an inland river as far as the contraction extends. We may perhaps indulge our conjectures still further in supposing that Sky was once united to the mainland by means of this alluvium, and that the gradual effect of the tide circulating through the bay on each side had at length produced the effect in question; an effect not at all inadequate to its powers, and of which parallel examples occur in the lateral action of rivers on the alluvia of valleys; as on the banks of the Tay and in many others of the principal rivers of Scotland. Greater effects have often been attributed to the corrosive powers of the sea. I may remark that the narrowness of the channel, which in one part does not exceed a quarter of a mile, and the shallowness of the soundings compared with the depth of those which separate the other parts of Sky from the mainland, are friendly to this supposition. These scarcely exceed ten fathoms in the middle, although there are some deeper holes on each side ranging to thirteen, the bottom being every where gravelly, as if, like the banks, it was the remains of some former alluvium.

The topography of the rocks of this island has been already noticed, and may be deduced with sufficient accuracy from the preceding remarks and from the map. The order in which they may be observed to follow each other may be described in a general way in few words.

To gneiss, as the lowest rock, succeeds an alternation of graywacké slate, red sandstone, compact grey sandstone or quartz rock, and common white quartz rock; the gneiss in one part of its course passing by an insensible gradation into this series. After that follows a shelly limestone, alternating with shale, and with a crystalline limestone resembling those of primary formation. To this there appears to succeed again the alternation of red sandstone and graywacké schist described above, followed once more by the same shelly limestone and shale, each of these portions of calcareous rock containing the same oblique gryphite ammonita, and terebratula. These strata are lastly followed by another set of stratified rocks, consisting of calcareous sandstone, limestone, and shale; the whole being intersected and succeeded by different members of the trap and syenite family in the usual irregular and overlying position.* The arrangement thus briefly detailed is in some respects strictly geological, while in other points it will be found fallacious, as will be shown in the course of the ensuing detail.

In entering on the description of gneiss as the lowest rock, it must be premised that I have chosen this term as a general one, to prevent repetition or prolixity where general features only were to be described. Respecting the varieties included under it, I need add nothing to the general remarks formerly made on this subject; but in describing the individual beds of this series, I have with mineralogists limited the term gneiss to its strict use; distinguishing by a separate description those substances which differ from it in structure or composition, and giving to the alternating rocks of other characters their received appellations.

In choosing the most obvious character as the criterion of the upper or lower parts of any inclined series of beds, it is taken for granted, that no set of strata has been so entirely changed from its original position as to have passed the perpendicular and acquired the opposite dip. But in the present case the upper portions are in reality determined by the rocks that follow, and we may therefore conclude the rule to be here inapplicable; since the lowest portions of this gneiss are the uppermost in geological order, being in contact with those strata which are known from other circumstances to succeed in the order of superposition. It is nevertheless convenient to commence the description from this part of the series.

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* Plate XIV. fig. 1.

At one extremity the gneiss is defined by a line commencing near a small indentation marked in the map opposite to Isle Oransa: it will hereafter be seen that at the opposite end of that line the boundary cannot be fixed; a circumstance indicated in the colouring of the map. This line cannot be traced consistently even through the extent thus defined; the accumulation of soil, and other causes, preventing a view of the rocks in many parts of the space over which it extends: but as the indications of a rectilinear course are every where predominant, and as the actual boundary is often visible, I have without scruple defined it by a precise line to the eastward of all those points where its limit has been actually traced.

This line tends north-easterly, and will be found to regulate the direction of the edges of the gneiss beds wherever they are sufficiently persistent and elevated to give indications of their course. Their dip is toward the south-east, and will be found most constant and uniform wherever the rectilinear direction is most perfect. In one or two instances they subside to a very low angle or become actually horizontal, in a very few cases they are slightly displaced or bent, and in one or two only I observed the dip to be reversed. The angle of elevation varies so much in different places that no rule of general application can be given. Angles varying from 30° to 40° appear to be the most frequent, but towards the south-western extremity of Sleat they occasionally become vertical. Some of the minor disturbances and contortions seem to arise from the trap veins, which are abundant, traversing the gneiss in every direction. The others must be referred to the causes that have influenced the general arrangements of this rock.

The laminar structure prevails in the gneiss of Sky, which is identical with a very large tract of the same rock to be found in Glen Elg on the opposite mainland. Not only are the beds regularly disposed in parallel planes, but the structure of the rock corresponds to these, each substance that enters into its composition forming a separate lamina more or less extensive. No granite veins are to be seen, or, if they exist, they are rare, since none occurred throughout a very extensive and minute examination. I have formerly attempted to show that the contortions and irregularities of gneiss were accompanied by the presence of granite veins: the present example seems to confirm that view, while it also proves that they are not necessary to its constitution.

The predominant feature in the composition of this gneiss, is the abundance as well as the distinctness and red colour of the felspar, which is seldom entirely absent, even from those accompanying rocks of other characters that will hereafter be described. In the greater number of instances it is interlaminated chiefly with quartz; mica entering into the structure in very small proportion, and commonly occupying a distinct and thin lamina. In some cases the mixture is more confused, but generally the mica is even then in very small quantity. This variety of gneiss has a very peculiar appearance, from the contrast of the red and white colours; and, where the laminæ are even, it forms a beautiful rock.

The next variety consists of chlorite schist, felspar, and quartz, and here it may be a question whether, mineralogically considered, such a compound ought to be called gneiss. In the meantime, from the want of another name, from general similarity of character, and from the nature of the transition by which it passes into genuine gneiss, it may be allowed to stand as a variety of that substance.* In fact it is no farther distinct than are the varieties so abundant in the Long Isle that contain hornblende in lieu of mica; which have without scruple been ranked by geologists under the same term. These occur also in Sky, and, commonly, more or less intimately associated with the beds of hornblende schist that alternate with the gneiss.

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* I have already so arranged it in the Synopsis of Gneiss.

Together with these, which are the most marked and the predominant varieties, micaceous schist of two or three distinct aspects occurs. In general it forms beds of but small extent, the gneiss soon recovering its predominance; but in one or two places, masses of 100 yards or more in thickness are to be seen.

The beds of hornblende schist that alternate with the prevailing rock are sometimes simple, at others compound, containing felspar: they are frequently conspicuous for their magnitude.

Beds of chlorite schist passing into talcaceous schist, or into pale blue argillaceous schist, or into a graywacké, are also found in different places; and in some cases the mixture or alternation of the former rock with the felspar and quartz that prevail in the gneiss, is such, and the chlorite schist so predominant, that it is difficult to say under which of the two substances it ought in preference to be ranked.

A gradual change seems to take place along the eastern coast, from the simplest gneiss, which occurs near Isle Oransa, to the irregular varieties, which predominate at Armadale: while, as we proceed further to the south-west, the schistose ingredient increases nearly to the exclusion of the others. The last stage of the transition from gneiss to chlorite schist is effected by a rock as yet without a name; a compound of chlorite schist and felspar. There are two varieties of this; a laminar one, in which the two substances alternate and the external characters of gneiss are maintained; and another, in which the irregular laminæ of the schist are intermixed with arenaceous grains of felspar, so that the usual characters of gneiss disappear.

Other anomalous substances, which it is necessary to mention, are found in connexion with these rocks. One of these consists of a white felspar traversed by long prismatic needles of hornblende, and it occurs in a separate bed near Loch Oransa. In another, actinolite enters into the compound; and in a third case, quartz and felspar alone are united, sometimes in an indiscriminate mixture, at others by a dispersion of distinct grains of red felspar through a highly crystalline translucent quartz. This rock has been already mentioned as occurring in Tirey.

I think it unnecessary to enumerate any more varieties, and would willingly have avoided the detail of these, had it not been requisite to prevent misapprehension from the use of the general term gneiss. Without such precautions mineralogists can scarcely hope to understand each other; they are, like definitions, calculated to prevent mistakes.

In recurring to the changes in the composition of the gneiss between Loch Oransa and the point of Sleat, it must be remarked that this line is that of the direction of the beds; and that the change takes place therefore not by alternation or succession of beds, but in the prolonged course of the same set. Whatever difficulty may attend the explanation of this circumstance, it is not confined to this rock; nor is this, even here, a solitary case, since it will be seen, in describing the strata which follow, that they also are subject to the same irregularity; and in a degree fully as great, or even greater, since more at variance with the usual appearance of rocks that are in general very constant in their characters.

I must here drop the subject of the gneiss unconcluded, since that which remains is so intimately linked with the history of the next series of rocks, on account of the transition between the two, that it would not now be intelligible. I shall therefore proceed to consider this series in an order as regular as its ambiguous character permits.

In adopting a general term, something must here, as usual, be sacrificed to the convenience of using one only; I have therefore chosen the name of that which appears the most characteristic, if it is not the predominant substance, to wit, red sandstone, as it would be otherwise impossible to render the geological description intelligible. The latitude of this term is undoubtedly great, since various schists and other substances share largely with it in the tract to be described, but the adoption of either of these would have been still more objectionable.

It was already shown that the boundary of the gneiss at Loch Oransa is definite, and from this point it will be most convenient to commence the present examination. But it is impossible even thus to pursue this investigation in the usual regular order from the lowest to the highest of the entire series, even if the lowest could actually be ascertained throughout the whole line. The causes of this will be found to consist in the varying composition of the beds, taken longitudinally, or according to their direction. Hence it happens, that although certain portions are regularly prolonged in the rectilinear direction, they will be found to present different substances throughout their course, just as they do when examined transversely, or according to the order of their succession. It will therefore be necessary to select certain portions of the whole in a transverse order; noting the chief differences that occur, and connecting them as much as possible by those features which are common to all, namely, their dips, bearings, and connexions with the rocks above and below.

With trifling exceptions, which will be noticed in their proper places, the bearing of the whole series corresponds to that of the gneiss, and is therefore north-easterly. But the dip is so various and uncertain that the record of the particulars must be referred to the details of parts, since it is in different places both easterly and westerly under various angles; while the strata often assume the vertical position also. As the most systematic regularity of the gneiss is found near Loch Oransa, so the position of the red sandstone is there also most uniform.

The gneiss at this place is of a decided character, and is followed towards the north-west by a few thin beds of micaceous schist; unless the presence of occasional grains of felspar only distinguishable by the lens, should induce mineralogists to consider this rock as a variety of gneiss. A space succeeds in which no rock can be detected, vegetation and alluvial soil occupying the ground in the interior, and gravel covering it on the sea beach. It is not improbable that these conceal some conglomerate; this being the natural position of such a rock, of which, in fact, portions are occasionally found in the interior country adjacent, without any other assignable connexions.

This vacant space is succeeded by a yellowish quartz rock, accompanied by a schist, which although it very often presents the characters of a clay slate, yet, more commonly exhibiting those of a fine graywacké, will probably be ranked with it by most geologists. I shall not be anxious hereafter to distinguish the different varieties of this rock, as the geological relations of all are the same.

The nature of the succession now described is so simple, and so conformable to the received order of rocks, as to lead to the natural conclusion, that the gneiss is regularly followed by micaceous and by graywacké schist; and were the investigation suspended here, as might easily happen, an observer would decide on it without hesitation; yet he would in this instance, as perhaps in others, substitute system for fact.

Where these beds of schist first appear, they are conformable to the gneiss in dip; but they almost immediately become reversed, and are found dipping to the north-west, yet without any change of character or direction. The angle of the dip is here from twenty to thirty degrees. Fresh substances shortly after make their appearance, and a rock with the characters, at times of quartz rock, and at others of common hard sandstone, and of various colours, whitish, blueish, or brownish grey, is found in repeated alternations with the graywacké schist. Approaching towards the end of Loch in Daal these beds become nearly horizontal, the elevation varying from five degrees to ten, but the dip continuing still westerly. Further on, it

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increases to thirty degrees or more, and then becomes again reversed to the eastward, under which inclination it continues for a considerable space. The north-eastern direction of the edges of the strata still continues, and, to avoid repetition, this must be understood to be a constant feature where the contrary is not expressed.

The reversal of the dip takes place in Ben na Ree, and the eastern dip, being once established, is traced towards the Kyle rich for a considerable space, when it is again reversed to the west. If the line of this shore be traced to Ben Ashlaig it will be found to correspond to the direction of the strata, and thus far therefore we have access to one limited set of beds only, along this whole line. Their characters throughout this space are very constant and uniform, since they consist entirely of the schist already mentioned, interlaminated with quartz rock of the same grey colour. The appearance of a regular succession of graywacké to gneiss is thus preserved for a long space, since the geologist does not easily discover that he is proceeding on one line only of the stratification. This conclusion is only invalidated by afterwards finding that no progress has been made across the strata, and that the beds not only change their natures in the course of their prolongations, but that the same schist alternates with the various sandstones even to the last moment of their recurrence in the order of succession.

It is necessary here to mention a small portion of gneiss, too trifling in extent to have found a place in the general account of that rock, but important notwithstanding its smallness, since it serves to indicate the continuous regularity of the bearings, as well as to prove the alternation of the gneiss with the sandstone series. It is to be seen at the foot of Ben Ashlaig, being marked in the map, and it will be found to project a little beyond the linear boundary of the coast which, as the map will also show, is continuous with that of the sandstone near Loch Oransa. It thus serves to indicate that the gneiss of Sleat and that of the opposite mainland are separated by the body of sandstone which lies to the south of Island Reoch and is succeeded by the gneiss of Glen Elg. Its character resembles that of the southern parts of Sleat, consisting of laminar felspar and chlorite schist, connected with micaceous schist and passing gradually into graywacké.

Resuming this series as it is displayed along the sea line, the alternations of schist and quartz rock are found to be succeeded by great tracts of the quartz rock alone, here, as before, generally very compact, though occasionally acquiring an arenaceous structure. It is at first of a lead blue, then grey, brown, reddish, or mottled, under some of which modifications it might with equal propriety be called an indurated sandstone. In composition it is subject to another material variation; the quartz becoming mixed with felspar of the same colour, so intimately, that the mixture can scarcely be detected but by the weathering of the surface, which becomes harsh and rough; the one substance decaying while the other remains. In some cases the proportion of felspar is so great that the quartz nearly disappears, the rock when weathered being easily recognised by the whiteness of its surface, and, though less easily, by its recent fracture. I have called it felspar from the result of its decomposition; it may belong perhaps to a class of substances (the compact felspars) which mineralogists have not yet considered with the attention they merit.

With no material change, the same substances continue all round this promontory by the Cailleach stone and Loch na Best to Moil Castle; and in this direction, nearly the whole series is traced transversely from its commencement to its termination.* For a long space the predominant dip is towards the south-east, but the beds occasionally become vertical. If this portion of the whole mass alone were considered, it would be concluded that the sandstone series was conformable to the gneiss, but it has already been shown to have the reverse position at its commencement, and will hereafter be seen to be similarly placed, not only at its termination, but in many intermediate places along the courses of the beds.

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* Plate XIV. fig. 3. This section will convey a general idea of the positions of the strata, sufficient for the purpose of elucidating the changes they undergo.

Although the schist is not abundant throughout the space which extends from the Kyle rich to Moil Castle, it is never altogether absent; while it again recurs with increased frequency and unaltered characters as the series approaches to its termination and assumes the more ordinary character of red sandstone.

At Moil Castle this character first becomes distinct; the individual grains of felspar and quartz being visible, and the rock in some places assuming the aspect of a coarse grit. On passing this point the beds become vertical without any change of composition, and then gradually incline to the westward; still preserving, for a long space, even where least elevated, an angle of not less than thirty degrees. Here, the blue quartz rock, the schist, and the red sandstone alternate; while the beds in their further progress upwards subsiding gradually to lower elevations, terminate at length in an angle of ten degrees, on the shore near Lucy, where, after the intervention of a sandy bay that conceals the point of change, they are followed in the same order by the limestone; the last beds for a considerable space consisting of an ordinary red argillaceous sandstone.

Such is the order of the north-eastern natural section of this series, and as the direction of the beds is rectilinear, it might naturally be concluded that the history of this portion would be that of the whole mass through its entire extent. This conclusion is proved to be fallacious by the examination of other portions.

In a country so encumbered with deep soil, such access cannot always be had to the rocks as to enable us to trace all the changes that occur; but the observations made in the interior include the most essential circumstances, and are fully justified by corresponding remarks made on the south-western shore of Sleat where the rocks are fully open to investigation.

The low valley that stretches northward from Loch in Daal does not interrupt the continuity of the strata, though it intersects the whole series. Between this valley and the line of coast just described the beds in the interior are, as far as can be discovered, consistent throughout, but in the opposite direction some considerable irregularities take place, which must next be examined by assuming a fresh portion that may be included between this spot and a transverse line crossing to the north-eastward of Ord. Fortunately the two shores of Loch Eishort are included in this division, and we are thus materially assisted in verifying observations less satisfactorily made among the boggy wastes of this obscure and difficult country.

Tracing from Loch in Daal to the west, the lines of bearing of the schistose beds, and of the varieties of quartz rock that accompany them, are found continued to the head of Loch Eishort with the usual easterly dip. But here that dip becomes suddenly reversed, while some beds are found in a vertical position; these, although they cannot be consistently traced, being probably situated between those of westerly and those of easterly inclination. Here also the ordinary red sandstone makes its appearance, first alternating both with the schist and the blue rock, but shortly becoming predominant, and at length excluding the other substances, while it preserves a western dip. Thus it continues along the north-west shore of that loch into the interior, until its termination in the syenite, which near the upper part of the loch covers the place where the junction of the sandstone and the limestone should be found. On the south-eastern shore there is much of the usual confusion of dip and interchange of substances; but to describe these would now only lead to fruitless repetition. It must be remarked that with all this confusion the line of bearing is still preserved with the greatest pertinacity, scarcely varying a few degrees from the true one; and, that, whatever alterations occur in the dip, there is no corresponding change in the substances, which continue to alternate without any regard to its variations.

Crossing now this series in a south-easterly direction towards the boundary of the gneiss, a great body of red sandstone appears, occupying the highest ridge and extending, as far as can be discovered, to the gneiss, although the actual junction cannot be traced among the incumbrances of the interior country. Its position appears to be vertical, and it is accompanied by schist, but in much less quantity than usual. This circumstance is important, since it thus follows, that in this portion of the series, the common red sandstone is found both in the highest and in the lowest position; while the schist, which in other portions was nearest to the gneiss, is here transferred to the intermediate beds. From this fact among others was deduced the remark, that the beds change their composition even according to the line of their prolongations. If the line of the lowest portion of red sandstone now described be prolonged to the north-east, it will be found to correspond with those near the Kyle rich which consist of grey quartz rock or indurated sandstone; while similar inconsistencies will occur in attempting the mutual prolongations of the other substances. This remark is of little consequence in a mineralogical view, since the composition of the quartz rock and of the sandstone is nearly identical; the differences consisting only in the very variable characters of colour and compactness. Nor is the occasional absence or presence of the schist a matter of surprise, as in many other cases, similar beds vanish and reappear in the same line, as they happen alternately to be enlarged or extenuated. But in a geological view it is of importance, because it establishes the identity of the whole as members of a common series, further proofs of which may indeed be considered as now superfluous.

The next portion to be examined lies between the line last described to the north-east of Ord and a parallel one drawn to the south-west of Dunscaich, and it presents irregularities even more remarkable than those above mentioned. Its most conspicuous feature is a range of white quartz rock, which forms in some places a single, in others a double ridge; overtopping the surrounding country and conspicuous at a great distance from its hoary aspect, which resembles that of thin snow. This appears to be about five miles in length, and where widest, about one in breadth. Above Ord it approaches the shore, while to the southward it retires more into the interior: thus deviating at the northern extremity about a point to the north, its prevailing direction being the same as that of the general series. It is thus marked in the map, although neither the construction of that map, nor the bearings which can be taken on the spot, are such as to determine its deviation accurately. In other respects it agrees with the ordinary members of the series, since the different rocks already described lie on both sides, proving it to be, like them, a part of the general mass. As it occurs also on the shore in a state perfectly accessible, and close to the red sandstone, with which it alternates, there can be no hesitation in admitting this conclusion. As far as can be ascertained, its position approaches to the vertical line, from which, in different places, it seems to incline in opposite directions. That portion found on the shore, forms the island of Dunscaich already noticed as the seat of an ancient fort. Here, as in the hills, the beds are remarkably distinct, parallel, and even, varying in thickness from three or four inches to a foot. This disposition is, on a superficial view, easily overlooked, as the surface of the rock is very uneven;

the strata being broken into prismatic fragments by joints similar to those of the schistose rocks, which they also resemble in their laminar divisions. The dip of these beds is south-easterly, at an angle varying from thirty-five to forty-five degrees, and they are followed in regular order by the beds of red sandstone of the neighbouring shore, which intervene between them and the high ridge above described. Near Ord, the same rock occurs in different places and in actual contact with the red sandstone, but dipping to the west; the whole series, after much confusion, having here at length assumed that westerly dip which is never again altered, but continues to its termination in the calcareoüs rocks that follow. The principal confusion takes place to the northward of a portion of limestone hereafter to be described, but is not peculiar to the quartz rock, or the sandstone, since the limestone also undergoes the same change to a more northerly direction with a vertical but vacillating position.

The predominant character of this substance is nearly that of common quartz, with a fracture approaching to the granular-splintery. Owing to its compactness the surface is often covered with that polished enamel which occurs so often on the pure quartz rock found alternating with micaceous schist, and of which examples may be seen at Balahulish and in many other places. Occasionally it is less pure both in colour and composition, but these varieties are of little importance. Near the limestone at Ord it becomes red, blueish, and grey, and, what is more remarkable, is often mottled with red and white in round spots, discovering on fracture a globular structure indicated by those colours. In all these respects it resembles the well known varieties of common red sandstone, from which it is only distinguished by its perfect crystalline compactness.

To the account of this transverse portion of the series it may be added that on the opposite side of Loch Eishort the ordinary red sandstone occurs with perfect regularity and in its most common form.

The last portion of this series commences at the line last described, and is continued to a point that admits of no definition, since here the transition into gneiss, to which I already alluded, takes place.

In following the eastern boundary, or lowest beds, of the sandstone series from Loch Oransa, it is not difficult to trace it in the regular direction for some miles, at least by those imperfect indications which alone can be expected in a country so encumbered with peat and vegetation. The gneiss is also to be traced parallel to it for some time, maintaining its regular characters as at the commencement of the line of junction. But at length the research becomes fruitless or impracticable, and it then becomes necessary to have recourse to the sea coast, for the purpose of finding in its proper place the expected junction. The indications afforded by prolonging the linear common boundary from Loch Oronsa, would fix that place between Daalvil and the point of Sleat: it cannot be precisely indicated for want of a name, but may be marked on the map by continuing the line just mentioned. No such junction however occurs, and instead of it there is found a regular gradation from the one series to the other, which I shall describe as it is to be seen on the sea coast, as it is there perfectly accessible; while it is so obscure in the interior that, added to its natural improbability, the description would not be understood, or might perhaps be attributed to errors in the investigation.

Commencing at Dunscaich, the beds of red sandstone are found dipping to the south-east and accompanied by the schist, their regularity being there as perfect as in the other places already mentioned. Proceeding southward that regularity becomes materially disturbed, but as a great number of trap veins occur in this particular spot, these irregularities may perhaps safely be attributed to their presence. Still tracing the beds to the southward as far as Daalvil we find no material alteration; nor does any reason appear for suspecting that we have quitted the sandstone series, till we arrive at that point beyond it where a portion of trap is laid down in the accompanying map. I shall describe this portion here, on account of its minuteness, instead of deferring the account to its systematic place.

It forms a bed distinctly overlying the sandstone, of an irregularly columnar structure with a schistose tendency and a slightly porphyritic character; the laminar direction being parallel to the axes of the columns, whereas in the claystone porphyry of Arran, it lies at right angles to them. The space it occupies appears to extend about a mile. There occurs under it a single insulated mass of conglomerate, consisting of a calcareous basis with imbedded fragments of red sandstone, sometimes angular at others rounded. The want of connexion between this mass and the accompanying strata, and the small space which it occupies, render it difficult to understand its relation to the sandstone; but it is probably the sole remaining part of a more extensive tract once continuous with the leading mass of secondary rocks that will be described hereafter.

Where this trap ceases, the sandstone series is again found, in no way altered, and from this place throughout all the remaining space it presents all the members formerly described except the white quartz; namely, the hard blue rock, the grey varieties, the common red sandstone, and the schist, in endless alternations. The dip still continues easterly, but the regularity which ceased at Dunscaich is never recovered; the beds undergoing undulations which at length increase to contortions and flexures such as are of common occurrence in micaceous schist and gneiss. Approaching still nearer to the point of Sleat, the alternations become so frequent that the laminæ of quartz or sandstone, and of schist, amount each to a few inches only in thickness; while the appearance produced in the sections, partly by this cause and partly by the contortions, is such, that in approaching to examine the rocks by the hammer we feel perfect confidence that we have at length arrived at the gneiss which we have so long been seeking.

The only change however to be traced is the more constant induration of the quartz, which becomes gradually crystalline, containing imbedded grains of red felspar, the schist however undergoing no corresponding change. But at length this substance acquires a greenish hue, while the felspar assumes a laminar disposition. Thus by degrees the rock passes into chlorite schist, interlaminated with felspar and containing sometimes talc and mica; while at length, arriving at the eastern point of Sleat, we gradually return to the modifications of gneiss formerly described, without having determined a point at which the one series ended and the other commenced; the direction and general dip having all along remained constant while the substances were changing. I may remark in terminating this account that the contortions last described are unconnected with trap veins; since, although these occur even as far as the point of Sleat, they cease to be numerous or remarkable.*

From the preceding facts, which have been detailed with a minuteness justifiable only by their novelty and importance, it appears, that there is in Sky a series of beds maintaining a regular direction, but with a variable dip, lying under a body of limestone on one side and in contact with a mass of gneiss on the other. This series consists of red argillaceous sandstone in various states of induration, of graywacké and simple argillaceous schist, of indurated sandstone or quartz rock of a blue, grey, and brown colour, often containing much felspar, and of common white quartz rock. Among the proofs given of the connexion of the members of this series it must be remembered, that the schist is not found exclusively at the lower part and the red sandstone at the upper, but that they both occur indiscriminately throughout the whole; a circumstance confirmed by their position in other parts of Sky as well as in some of the adjacent islands. It only remains to inquire in what class this series is to be placed, whether among the primary or secondary rocks. Those who should found their judgment on the uppermost portions, or on previous systematical views, would without hesitation consider it as a secondary rock, and as analogous to the red sandstone occurring in the centre of Scotland. As such indeed have the red sandstones of all this coast and of the adjacent islands been hitherto considered. But it has been proved both to alternate with and graduate into gneiss, and to consist of a great number of siliceous and argillaceous strata of different characters, some of which are common quartz rock. Under these circumstances we are entitled to consider it as a primary rock, it being no argument to the contrary that it is followed in parallel order by the secondary strata. This opinion is confirmed by the nature and position of the corresponding sandstone on the neighbouring continental shore, a full account of which will hereafter be given when the Sandstone islands shall come under review.

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* It will be remembered that, in describing the eastern shore of Lewis and that of North Uist, the transition of gneiss into an argillaceous schist was pointed out. There is a considerable analogy in those cases and the present one; and it is not improbable that if we could gain access to the continuation of that schist, from which we are excluded by the sea, we should find it to be part of a series analogous to that of Sky and connected with a similar series of sandstone. Additional instances in support of this opinion occur in many parts of the adjoining mainland, at Loch Carron, in Glen Elg, Kintail, and Sutherland, where similar transitions to schist and to red sandstone may be observed.

It is scarcely necessary in concluding this subject to point out to the reader the great thickness of this mass of strata, as it is sufficiently obvious from inspection of the map. It must be remarked however, that if with most geologists we suppose these beds to have been displaced from a position originally horizontal, the present is no criterion of the former thickness of the deposit. The reversed positions of the strata show that the points of elevation, (or of subsidence, since it is indifferent which is assumed) have been situated in various places; and it is abundantly obvious, that a single operation of this nature taking place in the middle of a horizontal mass would, when the change to a high angle occurred, double the original thickness. It will also be seen, that on this supposition some of the alternations which here occur may be fallacious; since if we assume, for example, two portions of red sandstone in reverse order, lying on the two sides of a vertical or intermediate bed of some other rock, these may originally have constituted but one stratum; the present appearance of alternation being merely the result of the change of position.

Although the preceding account terminates the history of the principal mass of the red sandstone, there still remain two detached portions requiring notice.

The least extensive of these is found at Loch Sligachan, where it is seen lying at the foot of the syenite mountains and consequently unconnected at one side with any other regular rocks; while at the other it is immediately followed in conformable order by the same limestone that succeeds the principal mass, the direction and dip of the whole being similar to those of that mass.

The second portion is of somewhat greater extent and more importance. It occurs on the shore at the foot of Garsven, extending along the sound of Soa for about a mile, and ceasing soon after the coast turns to form the entrance of Loch Scavig. Its breadth does not exceed four or five hundred yards, and, as the mountain rises suddenly from the water, it extends a few hundred feet upwards on the declivity. As no other regular rocks are here to be seen, its affinity with the other portions of the same rock is only ascertained by its position and mineral structure. In position it corresponds to the strata of Sleat, having a north-easterly direction and a western dip; while, its composition resembles the uppermost of these, consisting of red sandstone alternating with the blueish rock and with graywacké schist. The overlying position of the superincumbent trap is distinctly visible, as well as its contact with the strata; which are also traversed by numerous veins of the same substance, that do not however materially affect their regularity. Gravelly and conglomerate beds occur in this portion, and, like the former, it sometimes puts on the schistose structure. As, from its disjointed state, it presents, like that of Sligachan, no connexions that admit of tracing its relation to the great mass of sandstone or to the other regular rocks, I shall defer the consideration of this subject till a future time, when the examination of some of the isles adjacent to Sky will assist in throwing light on its history. In the meantime I may remark, that the position and western dip of both these detached portions, that of Scavig and that of Sligachan, give them the appearance of lying above the limestone, as I already hinted at the beginning of this article; a position which I shall attempt hereafter to reconcile with the ordinary arrangements in nature.

I can not yet drop the subject of the red sandstone without mentioning a circumstance which, although apparently trivial on a first view, is not unimportant in establishing the connexion between Sky and the neighbouring islands.

On the shores of Fladda (the small island situated in Loch Staffin) there are found numerous fragments of red sandstone with a few of gneiss, both of them being identical with the rocks of the opposite shores of Rasay and Rona. It has already been seen that in the former island the order of succession, from gneiss to red sandstone, and afterwards to the strata that appear on the north-east coast of Sky, can be traced. But the red sandstone is not found *in situ* in this part of Sky. If we consider the distance of the opposed shores and the direction of the tide stream, there is no reason to suppose that the detached stones of Fladda have been washed from Rasay, while there is no communication between these islands to authorize the supposition that they have been transported as ballast. It is therefore probable that the gneiss and red sandstone both exist below the sea close to Fladda, extending thither from Rasay; and we are thus enabled to compare at another point the connexions of the superior and inferior strata of Sky.

THE next rock in order is the limestone, the investigation of which was attended by greater difficulties than that of any rock in the island. The novelty of the facts will perhaps, like many of those formerly mentioned, excite in the minds of others, as it did in my own, a suspicion that the intricacy of the ground and the confusion of the several objects had led to some deception. My own suspicions have fully subsided, and a confirmation of the facts here stated having occurred in the examination of the Isle of Man, I can with the greater confidence proceed to give the history of this district.

Its geographical extent cannot be strictly defined, on account of the number of scattered parts which it presents; nor is even the map, from its necessarily limited dimensions, capable of supplying this defect. Fortunately a rigid topographical detail is but of little moment compared with the scientific interest it possesses, and there is the less reason therefore to dwell on those minutiæ, though they have been examined in the most scrupulous manner.

The irregularity of position and feature occurring in these strata are the first obvious deviations from that order which characterizes the preceding rocks, and which may now be said to cease through all the remaining part of the island. Although the whole of the scattered parts in question must be referred to the same variety, perhaps to the same deposit, of calcareous rock, yet the principal interest is contained in the first and most extensive tract that occurs, and from this alone the condition and connexions of the more remote and detached portions are capable of being understood.

This division occupies the district and parish of Strath, extending between the north-eastern and south-western shores. On the south-eastern side it is chiefly bounded by the sandstone already described; while the opposite one, stretching towards the syenite mountains, is extremely irregular, being not only marked by indentations and deficiencies, but confused in a manner that can not be rendered intelligible either by words or drawings. General description must here supersede the use of particular details, but it will be found adequate to the purpose in view. I may add that the term limestone is used in the following description as a general one, including the alternating beds of shale and sandstone, which will nevertheless be specially described wherever it is necessary.

Commencing from the lowermost beds it must be remarked, that it is impossible to trace their common boundary with the red sandstone, although there can be no doubt that they meet in a line which may be drawn from near Swishnish point to the farm of Lucy near Broadford. This arises, partly from the irregular form of the ground and the depth of boggy soil with which it is covered, and partly from the intrusion of the syenitic hill Ben na Charn, which is so placed as to cover a large portion of the joint boundary of both rocks. It is probable indeed that there is some disturbance of the limestone even at its lowest boundary; but as this cannot be discovered, and as there is a general appearance of regularity in the sandstone, we may perhaps safely conclude that the lowest beds are, in a general sense, parallel to this rock. The contact of the two may however be observed in a few detached points; in others, as near Lucy, where it might be expected, there is a very near approximation in conformable order; but the important interval, as most commonly happens, is filled with rubbish. This is a circumstance of frequent occurrence at the meeting of approximate rocks, and is a common cause of disappointment to the geologist. It seems to arise from a decomposition of the exposed parts of the substances at their junction; and occurs nearly as often at the contact of two stratified rocks as it does where these are traversed by the unstratified. Hence, from the wearing of the materials at the surface, a cavity is produced; which becoming subsequently filled with rubbish and generally covered with a vegetable soil of unusual depth, effectually prevents a view of the contiguous parts. It must however still be remarked respecting the common boundary of the sandstone and limestone, that although the course of the former is rectilinear within itself, and a similar straight tendency is to be seen in the latter wherever they can be traced, yet that straight line is not preserved at their junction; as the map will show that they are divided by a line which does not coincide with that of their bearings. It is easy to conceive, that, notwithstanding a perfect geological conformity between the two, such a disposition may result from the uneven state of the surface, or from variations in the dip. It may also happen that, with a similar general conformity of bearing, the limestone may occupy a basin-shaped cavity, and thus possess an uneven boundary; nor is it improbable that such is the condition of the strata in question. The reasons which render that supposition probable will manifest themselves hereafter, when the islands that adjoin Sky and resemble it in composition have been described.

In examining the two ends of the principal limestone tract, the one near Swishnish and the other near Broadford, differences will be found in the relative number of the calcareous beds compared to those of shale and sandstone, the greatest proportion of the former being at the place first named. This lateral variation in the course of one bed, or of any particular set of beds, is however so common as to render any further notice of it unnecessary.

Where the limestone first occurs on the north-eastern side of the island at Lucy, it is found dipping at the very low angle of 5° to the north-west; following, at the small and interrupted interval formerly noticed, the sandstone, which has here subsided from its usual high angles to one of 10°. It alternates here with beds of a brown argillo-calcareous sandstone, and, in further progress, with a shale which in many places becomes so predominant as altogether to exclude the calcareous rock. This shale is of a very compound nature, consisting of blue clay mixed with sand, mica, and calcareous matter; in some places also containing rounded balls of trap. It is tender and irregularly fissile into thick laminæ; and, like the sandstone, contains the same organic remains that are found in the calcareous beds. The limestone is always of a blackish blue colour, commonly fissile or thinly laminar; and, although generally of an opake earthy aspect, it sometimes shows a tendency to the confused and imperfect crystalline texture so common in primary limestones. In purity of composition it varies extremely, since it is frequently intermixed with one or other of the substances that compose the rocks associated with it, namely, slaty clay, or sand.

The organic remains are limited in variety, and very irregularly dispersed; being often absent for a long space, while in other cases they are much crowded together. The lowest beds seem almost exclusively occupied by gryphites; a few small and smooth terebratulæ being occasionally found with them. Casts of ammonitæ of a large size are also to be seen; but they are so imperfect that I have never been able to procure a specimen from which the description of the species could be collected. Higher up, as it appears, in the order of the beds, fragments of a small sulcated terebratula are also to be found; and still further on, large pectines occur in considerable abundance, accompanied by fragments of smaller shells so mutilated that it is impossible to refer them to any known genera.

From such remains, geologists have in many cases successfully determined the analogies and relative positions of strata; but they seem at the same time to have expected from them a more perfect demonstration than, in the present state of our knowledge, they are calculated to afford respecting the succession of strata and the different species of animal remains that occur in them. However worthy of confidence these distinctions may be in cases like those of the English strata, where a regular order over an extensive space is found to exist, it is not as yet safe to transfer the same criterion to detached deposits like the present; since the occasional absence of some, and the partial nature of many strata, added to our imperfect knowledge of fossil species, materially interfere with the use of this test. With respect to the rock under review, as it holds the nearest place to the primary strata, it is thus far analogous to the mountain limestone of the English. Yet this is not a proof of its identity, since the inferior strata of the secondary rocks are often wanting. If again we compare it with the lias of the same geologists we shall find it to differ in some important particulars from that rock, which will hereafter be shown to occur in this island with very unquestionable characters; nor is the nature of its organic remains sufficient in the present state of our knowledge to fix our opinions on this point. I shall therefore distinguish it by the name of the gryphite limestone, to prevent it from being confounded, till better proof of its identity be obtained, with the beds of lias above mentioned.

These calcareous strata are frequently found to contain interposed beds of trap, and principally on the north-eastern shore; which, being often laid bare by the destruction of the softer incumbent materials, are found divided into columnar figures. They are also traversed in various directions by veins of the same rock, which in Sky seem particularly to abound among the softer strata. Whether the apparent beds are also to be considered as veins, is a question that must be discussed when this rock shall hereafter be considered.

Proceeding along the Broadford shore to a small point north of that village, the junction of the syenite and the limestone is seen; but the shale is in this place the predominant substance. The overlying disposition and the contact of the syenite with the inferior beds are here distinctly visible for a considerable space, and are not attended with any disturbance of their regularity or alteration of their texture. But having once arrived here, the boundary of the limestone becomes irregular, nor can it any longer be found in the interior, which now rises into the high group of syenitic hills of which Ben na Caillich is the principal. Although detached portions of the flat beds can still be traced along the shore, they are much intersected and obscured by syenite and trap, nor does limestone again appear for a long space, all the beds visible consisting of shale. At the entrance of the sound of Scalpa these cease and are replaced by a gravelly shore; after which a patch of limestone again appears, involved in syenite and trap, and no longer disposed in flat beds, but assuming that irregular structure of which numerous examples will be described in the course of this examination. Here at length the syenite becomes exclusive; the limestone entirely disappearing, not again to occur but after a long space and in a detached portion which will be examined after the principal district has been described.

Proceeding now across the country to the south-western shore, the interior presents a scene of confusion that no ingenuity can develope; in which stratified and unstratified limestone, calcareous conglomerates, quartz, sandstone, and syenite, occur in apparent defiance of all regularity. I shall attempt to describe these rocks in the best order they admit, and finally to trace the causes of the irregularities.

Commencing at the lowest beds of limestone, or on its south-eastern edge, the same flat strata which occur at Broadford are seen in the interior, rising into high hills and forming a lengthened irregular ridge towards Loch Eishort. So little of the ground is here uncovered that it is often impossible for a long space to procure any sight of the rocks; and it is only by the most trifling indications, that their course can be pursued across the country to the opposite shore. The occasional occurrence of the same shale and sandstone that are found at Broadford, equally mark the coexistence of these strata; while the identity of the whole is placed out of doubt by the gryphites which are found, either imbedded in them, or scattered about among the fragments that lie on the surface. The greatest interruption experienced in this line is produced by the syenitic ridge marked in the map, the whole of which I shall distinguish by the name of Ben na Charn, since other names are wanting, although this title is only applied to its western extremity.

As it will be found conducive to clearness, to reserve the whole description of the western shore of the limestone for one place, I shall here drop the pursuit of the lowest beds on this line and proceed in geological order upwards through the strata, by descending a stage nearer to the valley of Strath; the lowest beds in altitude being here often the highest in geological position.

Proceeding thus to the south-west along a new line, taken still from Broadford but at a point more north-westerly, the limestone, which is at first concealed from view, becomes shortly very conspicuous; protruding through the soil and rising above the surface in grey low rocks visible at a great distance from the clearness of their colour and the total absence of all mosses or lichens, to which they seem never to afford the slightest hold. It forms in some places two distinct ridges, one of them presenting near Broadford a high range of continuous hilly ground; while in other parts these unite, or become confounded by the intricate mixture of some new eminences, or by the subsidence of the ridges themselves. Finally they decline north-westward into the valley, where, from excess of soil and vegetation, the protruding limestone gradually disappears.

Traversing the most conspicuous part of this irregular ridge, no marks of stratification appear, but, in its place, an irregular unstratified mass succeeds, totally dissimilar to the former, and presenting the other characters usually found in the primary limestones, namely, a crystalline texture, colours in which white and pale grey are predominant, and a total absence of organic remains. The same characters are found occasionally extending even to the foot of the syenitic mountains to the northward, wherever the limestone, which is not often accessible, can be found.

In this irregular mixture of secondary stratified limestone and of unstratified crystalline masses, consists the obscurity that involves the whole of this calcareous district; the indications by which the two are connected being so rare and so obscure, that they afford no grounds for any conclusion, should they even excite suspicions with regard to the nature of this connexion. I shall mention the most remarkable examples that I observed; the explanation will scarcely appear till the line of the western shore is described.

Not far from Broadford a solitary rock is seen, of a character so doubtful that it is difficult to know in what division to place it. Possessing the colours and crystalline texture of the unstratified limestone it is disposed in beds, but of much greater thickness than the ordinary strata where these are regular. On weathering it presents numerous cavities, produced by the dropping out of various irregular bodies consisting of a whiter and purer limestone than the base, the crust which united them to the mass of the rock having been destroyed. On a distant view they resemble shells, but the resemblance disappears on a nearer inspection, while the fresh rock shows nothing, on fracture, but a confused assemblage of lumps of different colours. There will hereafter appear reason to think that they have had their origin in organic substances. Returning to the interval between the stratified and unstratified rock near the syenitic hill Ben na Charn, portions of the limestone are found, possessing the general characters of the unstratified rock; but traversed by parallel planes of a slaty substance much harder than the shale of the stratified limestone, and indicating by this obscure appearance of stratification, a community of character between the two. In a similar situation the same limestone is regularly interstratified with beds of quartz of the most ordinary aspect, a foot in thickness, and bearing the same analogy to the crystalline limestone which the sandstone formerly described does to the earthy limestone of Broadford. Gradations of character also take place among these quartzose strata; some of them being undistinguishable from the indurated portions of sandstone that occur in particular situations among the ordinary soft sandstones of the latest date. There is yet a still nicer transition from the stratified to the unstratified limestone, immediately below the syenite of Ben na Charn; the beds lying in the usual position and containing the shells already mentioned, but the rock itself being of a crystalline character, and weathering into that very singular honeycombed, or spicular and ridgy form which, with its durability and hostility to vegetation, distinguishes so strongly the stratified from the unstratified rock.

The last affinity between the two which I shall here notice, is the occurrence of substances in the unstratified rock, so nearly resembling those ranked under the general term of alcyonium, that it is probable they owe their origin to organized bodies. They are occasionally disposed in an irregular manner, but in some places form layers in the rock as distinct as those by which the flints of chalk are characterized. They consist of a calcareous carbonate, whiter and harder than the surrounding rock, and are covered with minute crystals of the same substance, of a peculiarly brilliant aspect. Their superior permanence causes them to protrude long after the including mass has wasted away, and they can thus be easily procured in an entire and separate state. In a few instances they are found broken into two parts and reunited by intervening limestone, without any material disturbance of the separated portions. The occurrence of the rare and beautiful Dryas octopetala in great profusion, will guide the geologist to this rock, which might otherwise escape his observation.

Before quitting this part of Strath I must mention a substance connected with the limestone, because it can no where else so well find a place, and is not sufficiently extensive or important to require a separate consideration. This is a calcareous conglomerate, occupying a portion of the hill next to the syenite so often mentioned; but its connexions cannot be traced. That however is of little moment, as the occurrence of similar conglomerates among such beds is not uncommon. It consists in general of fragments of different coloured limestones united by a calcareous cement; but in a few places, as towards Broadford, where it is found in the same line dispersedly, it also contains fragments of quartz. It is probably situated between the sandstone and the limestone, this being its natural place; while its partial occurrence may partly arise from obscurities produced by the ground, and partly from its occasional absence, of which, in analogous cases, examples are not wanting. On concluding the account of this conglomerate I may remark generally, that I have not been anxious to record those which occur in Sky. They are very unimportant in their topographic extent, and being in a general view portions of the series with which they are found, they are often implied in the descriptions of the principal strata where they have not been particularly specified.

To avoid recurring hereafter to this district, I shall here notice the scattered manner in which the syenite occurs in it, although properly belonging to a future stage of the description. Besides Ben na Charn, a second ridge is found extending from Kilbride, and separating two portions of limestone. Together with this, several partial spots of the same substance occur dispersedly among the limestone, not only in the hills above, but in the lower parts of the valley, where the great continuous mass that occupies so large a tract in the island first commences. The positions of these several portions are such that they cannot, for want of local references, be accurately pointed out; while they are often so small, that no map on an ordinary scale is sufficient to represent them. It must suffice that they have been thus, generally, enumerated; and I have only to add, that they are distinctly to be seen lying over the limestone, even where it possesses the stratified character; while in other places they penetrate the beds in a manner which will be more properly described hereafter. The trap veins that occur in this district must also be referred to a future part of the description.

I shall now proceed to examine the remainder of this limestone as it occurs along the shore from Loch Eishort to Kilbride; where a more distinct sequence of the most interesting parts will be found, and where the solution of the preceding difficulties will be more apparent.*

In Loch Eishort it is first visible near the farm of Borrereg, but under a very irregular form. There is here an interval filled in the usual way with soil and rubbish, that prevents its contact with the sandstone from being discovered, and it is possible that in this interval the conglomerate, which might be expected to separate these two rocks, exists. Like some of those already mentioned in Strath, it is disposed in thick naked protruding beds without the laminar structure, and is destitute of organic remains. The texture is also crystalline, and it has the peculiar cavernous surface by which the unstratified limestone is almost invariably distinguished. The direction of this mass is much more northerly than that of the surrounding rocks, as is more clearly indicated in the map. The portion now described is but of small extent, and is immediately followed by a similarly narrow and parallel stripe of white quartz rock resembling that of the opposite coast, which is again succeeded by another portion of limestone similar to the former; after which the ordinary stratified limestone immediately commences, to undergo no changes of any moment till we pass the point of Swishnish and thus, advancing upwards in the order of the beds, draw nearer to Kilbride. Immediately after the calcareous strata appear they are found alternating with the brown calcareous sandstone and the shale already described, containing the same shells and placed at the same low angles of five or ten degrees. The ammonitæ are here more abundant than on the eastern shore, but they are even here so imperfect that little of them can be discovered but their casts in the surface of the rock where it is corroded by the action of the sea.

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* Pl. XIV. fig. 2.

With some material interruptions from trap, the beds of limestone and the associated rocks are continued with the same regularity round the point of Swishnish towards Kilbride; that point being occupied by a mass of sandstone which will be more properly considered after the limestone, as it is superior in position.

The only difficulty that occurs in this place is that of the quartz which intervenes between the two masses of unstratified limestone; nor can I pretend to suggest any other explanation of it than that which has already been proposed on similar occasions. I shall therefore proceed to consider the remaining changes in the calcareous rocks that are visible through the small space which now remains to be examined.

To render this description clear it is necessary to return to the original point at Loch Eishort, where the series of beds which follows the unstratified limestone is in contact with it. At the very point of contact there is an interference of the two, which is highly satisfactory, as tending to establish their perfectly consecutive nature, and consequently to determine the place of the former limestone without the shadow of a doubt. Where they meet, two or three laminæ of the crystalline limestone alternate with an equal number of the common one; and they are readily distinguished, because the former being mixed with a hard schist have a superior degree of permanence, and project on the corroded sides of the latter. The same contact of the two occurs at Kilbride; but the same interference is not visible, although the parallelism is perfect.

From each end of this junction the ordinary limestone beds may be traced all round the point which separates Loch Eishort from Loch Slapin, intersected every where by trap veins. Neither the thickness, the number, nor the order of these beds can be ascertained, as they are much too complicated and difficult of access to admit of such an examination. The very attempt would be a superfluous endeavour after accuracy, since enough of them is ascertained to prove that which alone is important to be known, namely, the order of their arrangement, and the characters by which they are identified with the other strata already described. In general they are disposed alternately in thin and thick laminæ, formed of a dark blue earthy limestone, at times somewhat crystalline, and interleaved with argillaceous schist of various dimensions. These beds are here inclined at an angle of about twenty-five degrees; they seem most regular as well as thickest at the point of separation between the two Lochs Eynort and Slapin; while near the same place they are also occasionally found in very thin schistose laminæ, so that no rule can be laid down respecting them: I may add that they are found occupying the island of Heast, as well as a long ridge of rocks which here intersects Loch Eishort.

It is now proper to remark, that although the general aspect and disposition of the calcareous beds on this shore is the same as on the Broadford side, and that they contain the same organic remains, they present differences that serve to mark the commencement of the change from the common stratified to the irregular crystalline rock. While the beds are thicker they are also much harder, and more frequently approach to the crystalline state; and in lieu of the tender shale which there separates them, they are here divided by a hard schist having the characters of a fine graywacké. Under similar circumstances it has already been seen, that quartz and indurated sandstone are found occupying the place of the ordinary soft sandstone which occurs among the common limestone.

The obscurity which hangs over the connexion of the stratified and unstratified limestone in the interior, is here completely removed, partly by the circumstances just described, and partly by the two following appearances. In one place a mass of the latter rock is found interposed among the beds of the former, into which it graduates more or less perfectly on each side: thus it may be considered either as alternating with them, or as a portion that has undergone some posterior change from the influence of a more recent cause. Under either supposition it is plain that the unstratified is not a primary rock, but that, notwithstanding its peculiarity of characters, it forms an integrant portion of the secondary strata, whether or not the causes of that peculiarity can be explained.

Near Kilbride a mass of the unstratified limestone is found situated near to one of syenite, which here appears to intersect the whole body of the strata, as it is found to do in other places. Although the actual contact is, as usual, unfortunately obscured by a cavity filled with rubbish, yet there is here an opportunity of tracing by a very perfect natural section, the change which it undergoes between the regular calcareous beds which lie near it on the one hand, and the irregular surface of syenite to which it approximates on the other. At this latter surface it bears no marks of stratification, but is an irregular and almost shapeless mass, while near the beds it becomes first vertical and gradually more regular; till at the end, its general bearing, although much deformed by fissures, partakes decidedly of the general inclination of the stratified rock, which is here about twenty-five degrees.

The sketches* which accompany this article will render the nature of these connexions more intelligible than any description could, and they will also serve to explain the anomalous appearances described as occurring in the interior.

As the mineral characters of the unstratified limestone have been but cursorily mentioned, it is necessary to detail them somewhat more particularly.

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* Plate XVIII. fig. 3, 4.

It is in the first place remarkable, that with the exception of the very doubtful organic substances resembling alcyonia, it contains no shells, although the neighbouring beds into which it graduates are full of them. The peculiar blueish grey colour which it acquires on weathering, and which renders it so conspicuous at a distance, has been already pointed out. This change is accompanied by a singular mode of wasting, in consequence of which it becomes eroded in a cavernous manner, the cavities lying on the upper surface like the cells of a honeycomb, rounded interiorly, varying from six inches to a foot in depth, and separated by acute narrow partitions. This appearance seems to result from the access of water to its numerous fissures, which thus enlarges them by a gradual solution of their sides. As it no where presents seams of stratification except where it graduates into the ordinary beds, and is fissured in various directions, it can be raised in large irregular blocks only. Hence it has very naturally been considered as a primary limestone. This error is confirmed by its texture as well as its colour, both of them resembling those which are supposed to be characteristic of primary limestones. In these respects indeed it possesses an exact resemblance to those which are found in various parts of Scotland associated with schist, gneiss, and granite. From this we ought to receive with distrust any attempt to distinguish the primary and secondary limestones by internal characters, nay even by their external forms, since in this respect also the rock of Strath bears a perfect resemblance to the primary limestones already alluded to. The texture is almost every where compact, the fracture being sometimes finely granular in the surface, but generally varying between the splintery and conchoidal. It is commonly very brittle, a character rare in the stratified limestones, and in many places it even breaks with the violence and cleanness of siliceous schist. With respect to chemical composition it is generally pure; but where in contact with the syenite or the trap veins, becomes overloaded, not only with silica, but with magnesia and argil also. In such situations it often contains veins and nodules of greenish transparent serpentine, and adopts a variety of colours; circumstances in which it also resembles exactly those limestones which in Glen Tilt are found in contact with granite, or at Balahulish and in Tirey and Iona, with micaceous schist and gneiss. The predominant colour is grey, varying from nearly white through all shades of dove colour to a dark blue grey; sometimes beautifully striped, and occasionally mottled or veined: in many situations it is of a pure snow white, forming a perfect variety of statuary marble, and affording as yet perhaps a solitary instance of this variety of limestone occurring among secondary strata. In calling this a solitary instance, I may however suggest, that when more attention shall have been paid to geological investigations many of the facts here enumerated will not appear so extraordinary as they now seem.

It is impossible to conclude this part of the description without inquiring into the probable causes of this confusion of character or change of structure in the limestone deposit. It will be easily conjectured that I am inclined to attribute the whole to the influence of the syenite. This rock is found at one place, if not actually in contact with the limestone, at least at a very small distance, since the interval formerly mentioned at Kilbride amounts only to a few feet: in other cases there is a nearer approximation, but, as already remarked, the interior country is too much obscured by soil to admit of very accurate examination. In some places, it is true, the unstratified limestone is found without the syenite, but the absence of this rock is by no means conclusive against its influence. The interior country bears evident and strong marks of recent waste, and the syenite of Sky is every where conspicuous for the rapidity of its decomposition. It may therefore have existed in many places where it is now no longer to be seen; while, from its intersecting and venous disposition, it may even now exist below the surface in many places where it is not visible. That the effect in question does not appear in every place where the syenite is actually in contact with the limestone, is no proof against this supposition; the negative in these cases being inefficient where all the accompanying circumstances are unknown. The same reasoning applies to the effects produced by trap veins on the adjacent rocks, which are equally uncertain; while their frequent influence in changing the calcareous rocks which they traverse, from an earthy to a crystalline state, presents an analogy so strong as necessarily to suggest itself to every geologist. The phenomena that attend the passage of these veins through the indurated chalk of Ireland, are in this view particularly worthy of notice.

I shall hereafter have an opportunity of adding some analogies to these arguments, in the account of the circumstances that attend the limestone of the Isle of Man; to which article I shall refer the reader and now proceed to examine the remaining detached portions of this rock that occur in Sky.

The first of these is found on the south-eastern shore of Loch Eishort at Ord, and although thus separated by the whole breadth of the water at this place, from the principal mass on the north-western side of that loch, the separation is more apparent than real; since the intermediate islets, as well as the numerous sunk rocks, consist of the calcareous strata already described; thus establishing their continuity between both shores. The space occupied by the limestone on the shore of Ord seems to exceed a mile in length, and its total extent may be conjectured with some probability, both from the form of the hill which it there skirts, and from the superiority of the vegetation in that spot; from both which indications, for want of others more satisfactory, it is marked in the map as including a roundish low hill of which the house of Ord is the centre.

The irregularity of its position is considerable, but in this respect it only partakes of the general disorder that equally attends the sandstone on each side. At its southern extremity the beds are even, and follow the general direction of all the strata, while they also dip to the westward. This regularity continues for about half the space through which it is visible. It then becomes so confused that it is difficult to discover a predominant tendency, immediately after which it is found lying in vertical beds and tending to the N. N. E. These acquire by degrees a northern direction with a slight western dip; when the limestone totally ceases and is followed by the white quartz rock formerly described, in a parallel order; but after a discontinuity of all rock occasioned by a narrow valley which on each side cuts off the hill of Ord from the adjoining land.

Although the junction therefore can no where be seen, there is, in the relative positions of the different rocks, sufficient reason for concluding that this mass is superior to the sandstone series, and consequently, that, however irregular in structure, it is one of the lowest portions of the series of Strath.

Whatever the irregularity may be, it is still always disposed in beds of greater or less thickness, which, on weathering, present much of the external aspect of the unstratified limestone formerly described. It is either of a dark lead blue, or a pale grey colour, sometimes earthy, now and then assuming a crystalline texture, and often extremely hard, with a clean and sharp splintery fracture approaching to the conchoidal. It is distinguished from all the limestone already described by the great quantity of siliceous substances it contains. These are either disposed in veins or in irregular nodules; in some cases so far predominating that the calcareous rock is nearly excluded, and in a few indeed entirely superseding it. In some parts the siliceous matter in question is that variety of chert which occurs in limestones; while in others it approaches so nearly to common flint that it can scarcely be distinguished except by the confused nature of its fracture. This substance is in some places of an obscure reddish or purple colour, more generally of the various tints of grey found in common flint; while in a few instances its aspect is such as nearly to resemble agate. Independently of this mineral, laminæ of a red schistose clay are found in some parts of the rock, which in these cases becomes itself schistose and impure, as if passing into a kind of calcareous or marly slate. To these I may add compact felspar, which is found in occasional masses or laminæ among the cherty nodules, but in one place only. This situation is singular, and not at all consonant to the usual habits of that mineral.*

If we may venture to speculate on the analogy of this limestone to those already described, the resemblance of the chert and red shale of the one, to the quartz and hard schist, and to the sandstone and micaceous shale of the other two, is sufficiently obvious: while there is the same probability that the anomalies in its appearance have been the result of the same causes which have produced the disturbance and change of texture among the surrounding sandstone strata.

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* Tripoli occurs in this place, and under circumstances which explain, at least one source, of a valuable mineral which seems to be formed in many different situations; and to be connected with rocks of very different characters, as far as the observations of mineralogists have hitherto reached. It encrusts the surfaces of some of the limestones, varying from half an inch to an inch or more in thickness, and being of a whitish or pale ochry colour; while the rock itself is of a smoke grey. It is evidently the result of decomposition; although it is not easy to explain how the action of the rains has washed away all the calcareous matter, leaving nothing behind but the loose and finely porous mass of silex which was once mixed with the limestone and now forms the mineral in question. In similar circumstances the same substance occurs abundantly near Diurness Bay in Sutherland, and the rotten stone of Derbyshire appears to have an origin, virtually, if not apparently, the same.

In describing the limestone of Strath I remarked, that although the linear direction of the strata appeared tolerably perfect wherever they could be fairly investigated, yet its boundary toward the sandstone was irregular. The extent of that irregularity is much enlarged by including the present portion, but for this it will be more explanatory to consult the accompanying map.

The next portion of limestone* to be found in Sky, is so widely and completely separated by the intermediate overlying rocks, from the great deposit of Strath, that it is impossible to trace any continuity between them, or to draw any inference respecting their identity, except by a comparison of their structures, or by a circuitous connexion through the neighbouring islands, where the same rocks are found in a more continuous and intelligible state. This occurs on the southern shore of Loch Sligachan, which it skirts to a distance marked in the map, forming a very low range of subsidiary hills at the foot of Glamich. The space occupied by it reaches but to a short distance from the mountain, where it is lost in the trap and syenite that form the mass of this and the neighbouring hills. In one or two places its junction with the overlying rocks may be seen, but so obscurely, that their connexion is inferred chiefly from former experience of similar phenomena. It is also important to remark, for the purpose of hereafter connecting this limestone with the strata which follow, that high up in the mountain a portion of white calcareous sandstone is found entangled in the trap.

The direction of the calcareous beds is north-easterly, and in this respect they correspond with those formerly described, as well as with the neighbouring and similar rocks of Rasay, to which their line of bearing can be prolonged. Their dip is also to the westward, but the angle is higher than is usually found in other places, since it occasionally reaches even to seventy degrees. The substances that belong to this deposit are the same as those of Broadford, and they need not therefore be further noticed; their identity being proved by their composition as well as by the presence of the same organic remains. I must however remark that the strata which lie at the greatest distance from the mountain are regular, but that nearer to it the limestone puts on the same appearance as the unstratified rock of Strath. The conclusions to be drawn from this correspondence, respecting the probable influence of the trap, are too obvious to require further notice. It is perhaps almost superfluous to say that the whole mass is much traversed by trap veins.

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* Plate XIV. fig. 1.

As the space occupied by Loch Sligachan amounts to nearly a mile in breadth, there is no opportunity of tracing these beds upwards according to the order of succession; but the first regular rock to be seen on the opposite shore is a white calcareous sandstone followed by a black and highly indurated one; both lying in the same conformable order to the limestone, and, for the present, indicating its termination. These sandstones will be described in their proper place; and as the occurrence of trap rocks attended by great consequent irregularities, insulate this limestone from that which follows, and of which the irregularity is still more remarkable, it is here necessary to stop and attempt to determine its affinities before proceeding to difficulties still more complicated.

For this purpose it will now be convenient to refer to the account of Scalpa, (which has unavoidably been made posterior to that of Sky,) and to that of Rasay already given.* In examining the former it will be seen, that it consists chiefly of red sandstone similar to that which lies to the east of Broadford, but separated from it by an intervening tract of limestone occupying Strath, Pabba, and a small part of its own southern shore, and dividing at the same time that limestone from the corresponding one of Rasay. There can be no doubt respecting the identity of the limestone of Pabba, Strath, and Scalpa, or of these with that of Sligachan; and, as the prolongations of the latter are continuous with the corresponding beds in Rasay, the community of this whole deposit is sufficiently confirmed. The nature of the difficulty respecting the position of the sandstone of Scalpa, is examined in another place, and the proposed solution involves that of the small portion of the same rock that lies under the limestone of Sligachan. Now as in Rasay the limestone and its associated shale are traced, by their resemblance and by that of their organic remains, to Scalpa, just as this latter is to the main deposit of Strath, and as in the former they are immediately followed by a great mass of whitish calcareous sandstone, there is reason to conclude that the corresponding sandstone on the northern shore of Loch Sligachan marks the natural termination of that limestone which has now occupied so large a portion of this account, and the commencement of the last and uppermost strata of Sky, which I must now proceed to describe.

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* Plate XV.

These rocks are found in two distinct divisions, widely separated by intervening trap; the most extensive range occupying the district of Trotternish with a portion of the same shore southwards, and the smallest occurring in the promontory of Strathaird and on the neighbouring point of Swishnish.*

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* Although it appears most probable that both these deposits are parts of the same, and that they both bear a common relation to the gryphite limestone already described, yet as all geologists may not agree in this opinion, I have represented them in the map by different but analogous colours, that I might not prejudge the question: an expedient the more proper since it is not the object of a coloured map to be a substitute for geological description, or an epitome of the scientific relations

The examination of these strata in Trotternish is a task of no small difficulty; in which, conjecture, or at least analogy, must often supply the place of observation.* This difficulty is caused by the trap which covers them more or less completely throughout their whole extent, whence they exhibit on the surface but occasional and slender indications of their nature, or even of their existence; a precipitous rock, or the section afforded by a stream, bringing a small patch or a few scattered fragments to light. It is only from the shore line, where the sections found in the high cliffs are continuously displayed, that a notion can be formed of their extent or dimensions; and even those appearances are so much involved and obscured by the trap connected with them, that they rarely allow the order of the strata to be traced; while their inaccessible state often compels us to judge of their composition by indications which ought never to be trusted where actual contact can be obtained. It may be added to these insuperable causes of obscurity, that even the natural order of the strata is inconstant and uncertain, and does not therefore afford that assistance which might, in conjunction with the accessible indications, allow us to ascertain the real order of their arrangement.

In examining this coast some assistance will be derived from a previous acquaintance with Rasay.† Other analogies will also readily suggest themselves to English geologists: if Scotland contains any similar collections of strata from which more convenient illustration might be derived, they remain still concealed to stimulate the industry of future observers in that neglected country.

Under the circumstances of obscurity and want of connexion in which the strata of Trotternish appear,

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of substances, but a brief and convenient mode of reference for topographic details that would either require tedious descriptions, or, for want of geographic marks, be unintelligible.

* Pl. XIV. fig. 1. † Pl. XV.

combined with their partial scattered occurrence and the absence of points for geographic reference, it would be useless, if it were practicable, to give a topographic detail of the places where they occur, as these could not be verified by subsequent observers. For the same reasons it is impossible to represent parts so minute in a map, however large its dimensions; and I have therefore been obliged to lay down the whole surface as consisting of trap, even in those places where the inferior strata come distinctly to light. They are indicated on the shore alone by a continuous exterior line of colour; even there incapable of being so varied as to distinguish the calcareous from the sandstone beds, and intended only to mark their boundaries on the sea line.

The examination of the surface of the country is not the less necessary; since, while it is required for determining the continuity of the strata, it serves, together with the altitudes of the eastern cliffs, to ascertain their thickness; or at least to assist us in forming a tolerable conjecture respecting that circumstance. If we imagine the whole of Trotternish divested of its mountainous irregularities, it can be reduced to a sort of inclined table land, of which the highest elevation will be found between Portree and Holme, and the lowest between Loch Uig and Duin. Wherever the land is so low as to coincide with this table, the strata are seen; subject however to the usual irregularities that arise from intervening and intersecting trap; and it will be found that their dip, which is to the north-west, conforms to this imaginary level. It is for this reason that they are thickest between Portree and Holme, where they form cliffs of five or six hundred feet in elevation; while towards Eilan Fladda northward, and Kilmuir eastward, they occupy low situations on the shore. It is thus evident, that the basis of Trotternish is a set of inclined strata, elevated and consequently visible on the east coast, but dipping to the north-west so as entirely to disappear on the opposite one after a very short indication of their existence. It is for the same reason that they appear no more, either on the promontory of Vaternish, or westward of that tract; their dip having carried them far below the sea, so that the trap alone occupies the whole visible land. The accompanying section will illustrate the notion here presented.*

Having thus sketched the general topography and position of these strata, as far as their obscurity admits, it is necessary to examine the order of their succession, and to trace them, by such indications as they afford, from the limestone strata of Sligachan formerly described.

Between these two places however there is such a geographical chasm, that the first step of this structure can only be laid by analogy; and in having recourse to Rasay for this purpose, I need not revert to the apparent connexions between this island and the opposite shore so lately pointed out. It has been seen that the limestone of Rasay, which corresponds to that of Sligachan, is followed in immediate succession first by beds of a micaceous shale containing numerous petrifactions, and then by calcareous sandstone remarkable for its spheroidal concretions, and of which the only conspicuous organic remains are a belemnite and a large ammonite. This sandstone forms a mass of great thickness, reaching to the surface of the island and apparently containing some portions of limestone, although the interference of the incumbent porphyry materially impedes accurate examination.

It must now be recollected, that the limestone of Sligachan is separated from the rocks that follow, by the interruption which that inlet causes. On its northern shore, there appear two thin beds of sandstone, the first white, and the second of a black colour, following the limestone in the same order and with a corresponding inclination. We may safely consider these separated parts as consecutive strata, and as continuous with the limestone, under the water by which they are divided. From this place to Conurdan nothing but trap is to be seen, and the first indication of the strata to be observed, is an irregular and thin bed of sandstone interposed between the trap, incurvated and without assignable dip, but of the same calcareous composition and displaying the same spheroidal concretions as the sandstone of Rasay. If these characters are not held sufficient to determine its order with respect to the strata at Sligachan, countenanced as it is by the parallel appearances in Rasay, the chasm must remain; although I have little doubt that geologists will consider the strata at Conurdan to appertain to those on the northern shore of Sligachan, and (abstracting the trap) to be the first in immediate superposition on the gryphite limestone.

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* Pl. XIV. fig. 4.

Proceeding northwards from this place along the eastern shore, the hill of Camiskianevig* rises suddenly, terminating in the sea by high cliffs. These are formed of a thick series of sandstone beds, surmounted by trap, and characterized by the same concretions as that of Conurdan; while they correspond in dimensions with the sandstone of Rasay on the opposite side of the strait. These beds disappear near the bottom of Portree harbour, not in consequence of their dip, but because they are cut through by the same mass of trap that surmounts them. On the north side of the harbour they re-appear with the same dimensions and characters, but after a certain progress are again cut through by the superincumbent trap, and thus divided down to the sea by a mass of that rock nearly a mile in breadth. They are again repeated in their original characters and dimensions, the cliffs rising to the height of five or six hundred feet and continuing with little variation to Holme, where some alterations in the form of the land prevent their dimensions from being further traced in a continuous manner. It is apparent, that at the point above mentioned, the same trap mass both overlies and cuts through the strata, the details being so obvious as to leave no doubt respecting the continuity of the two. But the rectilinear appearance of the strata is not altered at the place of junction, although it will hereafter be seen that in similar cases on this shore there are striking marks of irregularity and displacement.

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* Thus pronounced: in the Map, Cambustainabheig.

In attempting to describe the continuation of this coast I must premise, that it is often impossible to determine whether the strata which lie at an inaccessible height in the cliffs consist of limestone or of sandstone; since the external aspect of both, where they have been acted on by the weather, is precisely the same; the limestone acquiring a grey arenaceous surface, whatever its interior colour and texture may be, and the same spheroidal concretions and organic remains being found in both. It is plain that any judgment formed from the fragments on the beach must be imperfect, as there is abundant proof that the two substances alternate. I am nevertheless inclined to think that after passing Holme the limestone predominates, in some cases perhaps even to the exclusion of the sandstone.

The concretions above mentioned vary from two to four feet in diameter, and are in the form of oblate spheroids. As far as can be discovered without analysis, they only differ from the surrounding rock in hardness, and in consequence of this they are frequently found lying loose on the beach after the surrounding softer materials have been washed away. In a few instances they are united in pairs by a thick cylindrical stem, so as to resemble an ancient military projectile known by the name of double-headed shot; a peculiarity that has been noticed by foreign geologists.

The limestone presents various tints, varying from dark lead colour to smoke grey, and in some places it becomes of a dead greyish white. It is frequently so charged with argillaceous and siliceous earth as nearly to lose its character; in which cases it refuses to burn and scarcely effervesces with acids. The beds vary in thickness, but are generally thin, and divided by laminæ of schistose clay and by an impure argillaceous brown sandstone. I may remark that the only beach along the greater part of this shore consists of these flat beds, stretching out to a certain distance from the foot of the cliffs so as to be covered at high water mark, but accessible at low water; at which time alone it is possible to examine the rocks in a satisfactory manner.

The only organic remains which I observed in these rocks are a belemnite and two or three ammonites, and they occur both in the limestone and in the accompanying strata. The former is of a large size, varying from nine to fifteen inches in length, and is sometimes so perfect as to contain the interior septa of the shell. One of the ammonitæ is also of considerable size, varying from a foot to eighteen inches in diameter, and exactly resembling that found in Rasay. A second is of a smaller size, forming a distinct species, and both of these bear a considerable resemblance to the smaller species of this genus found in Somersetshire among the lias beds. A third, of large size, forms a species apparently new to conchologists, since the spiral terminates in a peculiar manner before it meets the centre, leaving an open ring in the middle, of two or three inches in diameter. I may add that the belemnites are abundant, but that the ammonites are rare; nor did I, on this part of the shore, discover any other species; the gryphites, pectines, terebratulæ, and other shells found in the inferior limestone having disappeared.

At Ru na Braddan, beds of common black shale begin to make their appearance, but still in so disconnected a state that their relations to the preceding strata cannot be discovered. They appear nevertheless to be superior; and the position of similar beds on the western shore of this promontory seems to confirm this opinion. I shall refer to a separate place the appearances of coal and of silioeous schist, which occur here; and to the division which treats of the overlying rocks, the numerous derangements and irregularities that accompany the intrusion of these.

The stratified rocks disappear entirely for a certain space near the northernmost cascade formerly described, but are repeated with more or less irregularity as far as Loch Staffin, on the eastern shore of which they finally vanish. The calcareous strata here alternate with common shale, as on the western shore; and, from the statement formerly given respecting their dip, there is reason to conclude that these beds are the uppermost of the whole series. The organic substances that occur among the lower beds, here disappear, and are replaced by others of a different nature. These are in many places so abundant that the whole body of the rock seems an entire mass of shells, belonging apparently to two or three distinct species, but all too imperfect to admit of their characters being determined. It can only be said that they bear a resemblance to ostreæ and to terebratulæ: there appear also to be remains of some other bivalves, but in such a state as to defy all conjecture. It is worthy of remark however, that one of the beds, which seems to consist almost entirely of a condensed mass of minute terebratulæ, is also found in Egg; a circumstance which I shall have occasion to notice hereafter. It must be added that beds of fetid limestone are found among these strata.

The map will show that the small island Fladda lies at the boundary of the strata on this shore. Hence, all round the points of Aird and Hunish, the trap descends to the edge of the water, which thus excludes from view whatever may exist beneath it. Near Duntulm, the strata appear again; occupying however but a small extent along this shore, and exposing but a very thin edge. The prevalent alternations on this side of the promontory, consist of thin beds of limestone with shales of different colours and of different degrees of hardness, verging to siliceous schist, and interspersed with rare beds of a coarse sandstone that occasionally contains, like some parts of the limestone, fragments of carbonized wood. The organic remains found in these beds are the same as those last mentioned on the eastern shore; and, with the other circumstances already enumerated, confirm the view originally held out respecting the dip of the strata of Trotternish, by proving that these are the uppermost beds of the series. It is thus at the same time proved, that the shale also appertains to the upper parts of the deposit; a circumstance indicated by the frequent occurrence of this substance on the surface of the interior country.

It is now necessary to examine the last remaining portions of white sandstone that are found in Sky, which, if they do not possess a more intimate geological connexion with the gryphite limestone than those of Trotternish, are at least more nearly associated with it in geographical position. They are found in two places only, forming a small part of the point of Swishnish and a much more considerable portion of the promontory of Strathaird.*

The deposit that occupies the former situation rises into abrupt cliffs about sixty feet in height, and may be examined from the sea, although with some difficulty;

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* Plate XIV. fig. 2.

on account of the foulness of the shore and a cross stream of tide, which renders the approach of a boat difficult, and, in this windy region, often impracticable. On one side, the beds are seen to follow immediately after the gryphite limestone already described: on the other, the sequence is obscured by a mass of trap, superincumbent, and sending large veins through the neighbouring strata. The inclination of these beds is but slight, nor is it easily ascertained; it may amount to 5 or 10°, the dip being towards the west. It is with some latitude that this rock is classed with the white sandstone, as the prevailing colour of all the beds is grey. Those in particular which are most accessible, are of this colour, and contain much clay: a calcareous variety is also found among them; but the character of the whole so exactly resembles that of some of the varieties occurring on the eastern shore of Trotternish, that it is superfluous to enter into any further details respecting them.

Between Swishnish and Strathaird all connexion is destroyed by the intervening sea, nor does there occur in the latter situation any portion of the gryphite limestone from which to trace the order of the sandstone of that district. Notwithstanding certain differences of character however, such is its general resemblance to the uppermost strata of the remainder of the island, such its position and dip, and so near its place to that of Swishnish, that there can be no hesitation in admitting it as a member of the same series; separated from all its natural affinities either by the overlying trap or by the surrounding sea.

This rock extends from the termination of the trap on the western side of the promontory, round the point of Aird to nearly the upper end of Loch Slapin, preserving a great evenness of direction and consistency of character throughout this space. It is called a sandstone in a general sense only, as it will be seen that it also contains beds of limestone, but in small number and of very limited dimensions. The position of the beds is so nearly horizontal that it is rarely found to vary 5°, except on the western shore, where it occasionally ranges to 10 and 15°: the dip, like that of all the stratified rocks, is towards the west, the smallness of the angle in this, as in all similar cases, preventing its tendency, like that of the direction, from being more accurately specified. There is a peculiarity in the structure of these beds so remarkable, that it is necessary to point it out, and as it is difficult to render it intelligible in words, I have added a diagram* for illustration. Each stratum seems compounded of two parts, the one consisting of a single horizontal lamina, and the other of an inclined series; or, there is a regular alternation of a set of inclined with one horizontal lamina. These are perfectly defined, the intervals being deeply channelled by the weather, and the whole having the aspect of some of the carved ornaments of Saxon architecture. This appearance conveys, on a first view, the idea of a regular series of beds alternating with each other, of which the one is horizontal, and the remainder in an unconformable position to it. But it must rather be considered as the indication of an internal structure, of which however all marks disappear when a fracture is made; a case analogous to that which occurs in basalt and many other rocks, of which the internal structure is so often detected by the changes which they undergo on exposure to the weather. A similar case, which is described in the argillaceous schist of Isla, serves to confirm this explanation. The appearance in this latter instance so exactly resembles the present, that the same drawing will almost serve to represent both; and the nature of the cause is amply confirmed by this circumstance, that while the beds of the schist are apparently divided in the direction marked by the horizontal lines, they are fissile only in that which is marked by the oblique. It hence also follows, that if the fissile property of clay slate is the result of some internal arrangement analogous to crystallization, we are equally entitled to attribute the structure of this sandstone to the same cause. The inclination of the oblique laminæ to the horizontal, varies from 10° to 30°; but it is regularly in the same direction, the dip, if it may be so called, being to the south. This appearance is neither rare nor dubious, but is extremely well marked, and predominates throughout the whole range. The measurement of the parts having been mislaid, it is from recollection that the intervals between the horizontal lines are here stated to vary from one foot to a foot and a half. There is no difference in the quality of the two sets of laminæ, both being of white sandstone, generally more or less calcareous.*

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* Plate XVIII. fig. 2.

To enter more minutely into the composition of these beds, I may now remark that the sandstone often acquires the aspect of some of the most compact and crystalline varieties of quartz rock, while in other cases it has the lax texture of an ordinary freestone. In some places it is calcareous; the calcareous matter varying so much in quantity that the compound would sometimes be called a calcareous sandstone, while at others it would be described as a siliceous limestone: in the latter cases it is often dark brown, grey, or even of a dark lead blue. The beds of mere limestone are rare, and those which I observed lie towards its upper boundary: they are much more generally granular than compact, and some of them indeed formed of an aggregate of rounded grains of the size of mustard seeds; not much differing from some of the oolites, but more compacted, and generally containing, besides these grains, crystallized platy particles. These strata are intersected in a remarkable manner by trap veins;* but I shall defer the consideration of those to their proper place, the last in the history of the rocks.

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* Having mentioned the resemblance which the channelled surface of this sandstone bears to certain architectural ornaments, I may point out to artists the probable origin of some varieties of the hatching and vermiculation of rustic work, in the various modes of weathering displayed by many of the sandstones. In many instances the imitation of art is perfect; and among other places I may name an example at Roslin Castle, where the resemblance is so strong that it is at first sight difficult to believe that the chisel has not been employed in giving the stones their present appearance.

Reasons will hereafter be produced for supposing that these veins proceed from the great masses of trap which cover all the northern portions of this promontory; and these circumstances may perhaps assist in explaining the differences in character between the strata of this shore and those of Swishnish opposite to it. The examination of the southern and western shores of Strathaird itself will show that similar differences exist among these strata, even where they lie near each other and admit of being continuously traced. On the eastern side of the promontory and towards its southern extremity, the trap veins diminish gradually in frequency till they nearly vanish altogether, and about the same place the incumbent trap also ceases. Here the sandstone is found with its most ordinary characters, tender in texture, often calcareous, and generally white, but sometimes grey or brown so as not to be distinguished from that of Swishnish. It occurs in the same form on the western shore of the promontory, where no trap exists; and it here possesses the same complicated schistose structure as the hard strata; but more perfectly, inasmuch as the laminæ actually separate to a considerable depth by the action of the weather. If the dips of the strata on both shores are now compared, it will be seen that the same bed which is hard in one place is soft in another; this difference being regulated by the presence or absence of trap.

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* Plate XVI. fig. 1.

There is consequently sufficient evidence of the identity of the hard and soft strata, and therefore of the original continuity of those of Strathaird with those which now lie at Swishnish separated by the breadth of the loch. Omitting the character of hardness, there is a striking similarity between these different strata; the same varieties in colour and composition occurring both in the soft and in the hard; the grains of sand also that form the body of the rock being in the one case loosely aggregated and separated by calcareous matter, in the other condensed almost to the state of quartz, and in some instances converted into a cherty substance by a combination with the lime. It is needless here to dwell on the obvious explanation of these changes which the presence of the trap offers; since it is so nearly connected with many analogous phenomena that will be described in other parts of this work.

With these strata the description of the regular rocks of Sky terminates; but it will not be useless to bring under review the connexions of the whole, for the purpose of examining the analogy which they bear to similar rocks occurring in other situations. This is rendered the more necessary by the numerous irregularities they present; by which their natural order is so far obscured as to add materially to the labour of the geologist, and to interrupt equally that consistency of description with which their history might otherwise have been given. These increase nevertheless the interest of the phenomena; presenting at the same time a valuable set of facts for explaining analogous derangements of a less obvious nature, and affording useful lessons to the geologist who may engage in similar investigations.

It has been shown that the position of the gneiss is regular, and that under peculiar modifications it is followed by a series of sandstone, equally regular, of which the members are, with trifling exceptions, similar or analogous throughout, and persistent across the whole island. These rocks are not limited to the island alone, as their prolongations can be traced with the same regularity to the mainland and the adjacent islands, under no greater anomalies than can be accounted for by the trap rocks associated with them.

Immediately after this series follows a deposit of which limestone is the principal member. In the vicinity of the regular sandstone these beds maintain a nearly unviolated regularity of position; the exceptions which occur, arising from a minor degree of those circumstances that accompany the greater irregularities. But as they proceed upwards, the regularity of this disposition becomes materially affected, while they undergo considerable changes of structure; the outer boundary of the zone thus presenting a very irregular line, marked by the disturbance of some beds and the total deficiency of others. In analogous cases, where such rocks are followed by other secondary strata, they are equally regular at their upper as at their lower boundaries; these strata, here as elsewhere, consisting of shale, sandstone, and calcareous rocks, and the whole presenting a well-known set of natural affinities.

Together with these regular secondary strata, there are here found in many places a set of unstratified rocks, reposing on them, occasionally alternating in an irregular manner, and ramifying into veins of greater or less magnitude. If the contact of these overlying rocks with the strata be examined, it will be found that they are rarely parallel except for a small space; and that instead of lying upon them in an even manner, they join them obliquely or transversely, or meet them in other irregular modes. With similar irregularity, portions of the unstratified rocks intrude among the stratified, or fragments of the latter are found insulated among the former.

Where the limestone loses its order and disappears, a great mass of these unstratified rocks occurs, rising into high mountains and occupying nearly all the northern part of the island. This irregular mass commences at the northern side of Strath, at the upper boundary of the limestone series, and terminates partially at Loch Sligachan, being succeeded for a small space by a second portion of stratified substances. These are again interrupted by a second mass of unstratified rock, which although thus divided on the eastern side of the island, unites into one continuous mountain mass at a small distance westward. On the eastern coast, immediately succeeding this portion of unstratified rock, a sandstone totally disunited from all the former strata appears; being repeated with similar interruptions for a considerable distance along this shore, and finally appearing on the western side of Trotternish under equal circumstances of irregularity.*

The chasm in the strata thus produced here by the unstratified rocks, is filled by Rasay, Scalpa, and Pabba; and a series may thus be traced among the several islands, scarcely perfect in any one, but most continuous in Rasay; while in Sky it is so interrupted as to be undeterminable without their assistance.† The order of the whole is as follows; gneiss, red sandstone, gryphite limestone, white sandstone, limestone, and shale; the intermediate alternations being neglected for the purpose of condensing the series. In thus replacing the scattered parts, the white sandstone of Trotternish becomes approximated to the inferior limestone, and restores that continuity which the present statement was intended to establish. It may be added that the order thus circuitously traced on the east side of Sky is more visible on the west, where the immediate sequence of the upper sandstone to the gryphite limestone has so lately been described.

It is next necessary to inquire respecting the resemblance of these to analogous rocks found in other places.

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* Pl. XIV. fig. 1.

† Pl. XV.

The organic remains of Rasay have been shown to resemble those of Somerset and Gloucestershire, and they determine the series in that island to be analogous to the lias of the English strata. Even without this evidence, the limestone of Trotternish, with its accompanying shale and sandstone, exactly resembles many of these beds as they are found in England and Ireland, between which latter and the Western islands of Scotland there are some strong points of correspondence. It will hereafter be seen, in examining the general connexion of all these islands, that portions of the same series are found scattered throughout the whole; extending thus the boundaries of a *formation* which has been found in other parts of Europe.

We are not at present acquainted with all the marks that distinguish the limits of this series, nor is it by any means certain that our knowledge of organic fossils is sufficient for this purpose; were it even proved that there is a constant and inviolable relation between one series of rocks and one set of fossil species. Under these circumstances it may be questioned whether the gryphite limestone of Strath appertains to the lias; yet geologists will perhaps consider it the lowest part of this series. If this be established, the lias here reposes immediately on the primary rocks, to which I have shown the red sandstone to belong; the intermediate strata, which occur in England and in other places, being absent. Such irregularities are too well-ascertained to be now any longer subjects of doubt; and they will confirm to geologists the propriety of limiting their conclusions respecting the continuous nature of the rocks that occupy the earth's surface.

Before proceeding to the unstratified rocks which constitute the remaining and larger part of this island, it is necessary to describe some stratified substances connected with those that have already passed under review, but which being of an incidental nature could not have been examined without interrupting the order of the preceding account. These are, siliceous schist, chert, and coal; and as the two former occur in the same circumstances, and occasionally in conjunction, their history may in a great measure be united.

These are found in detached fragments under the high cliffs on the eastern shore of Trotternish, occurring in considerable abundance and variety among the fragments of the common strata that strew this beach. The coast is very difficult of access even in fine weather, and with a wind off shore; in other cases it cannot be approached, and, as the cliffs are perpendicular and inaccessible, the natural position of these substances cannot be discovered even after a successful landing. As it is only by the colours, the dimensions of the strata, and similar indications, that we can judge of the nature of the different rocks in these cliffs, there are no means of distinguishing between those beds that consist of common shale and those that may be formed of siliceous schist, and we must therefore be here content with examining the fallen fragments. But as these substances are accessible in other parts of Sky, disposed among the ordinary strata and accompanied in the same manner by trap, we are justified in concluding that they exist in the eastern cliffs in the same positions.

The siliceous schist presents various tints, varying from a pale to a dark grey and to an intense black. Occasionally the two colours are found disposed in stripes perfectly even and parallel, presenting a singular appearance when long rolled on the beach, as the grey variety becomes white on weathering while the black retains its original hue. On fracture, the cause of this appearance is found to consist in the alternation of laminæ of different colours; many of the fragments resembling striped jasper, some of the well-known specimens of which are evidently but varieties of this substance.

It may be said generally, that the blackest varieties are the hardest, and approach most nearly in their fracture and lustre to flint, although there are some exceptions to this rule. These are also the most brittle, and they are often indeed so fragile as to fly into small pieces before the hammer, rendering it difficult after numerous trials to procure a single specimen. It is in this state that the siliceous schist is known by the name of Lydian stone. While some of the specimens have the lustre of flint, others present a dry earthy surface, and with this aspect they commonly offer greater resistance to the hammer. The fracture is in all cases more or less conchoidal, but is largest in those specimens that present a dull surface; in the most flinty varieties a conchoidal and angular fracture are combined. Sometimes the fragments are found united to limestone in a parallel manner, clearly proving their original connexion; and in these cases the limestone, instead of the usual earthy aspect, presents a crystalline texture.

The fragments of chert are equally abundant, but being of a more durable nature are found of a larger size. They vary in colour from a greyish white to blueish grey; sometimes they are mottled, and occasionally they exhibit tints of greyish green. The fracture is commonly plain, or very large conchoidal, but so difficult to produce, that a hammer of four pounds weight is often insufficient to detach a single specimen from the block. Now and then they are somewhat more brittle, but in every case the thin fragment when procured has the sharpness of glass with a toughness approaching to that of iron. This chert strongly resembles that which is entangled in the pitchstone of Egg; still more nearly that of the Shiant isles, which will hereafter be shown to originate in the same substances, namely, the different beds of the lias limestone.

That evidence which is here wanting with regard to the natural position and affinities of the chert and the siliceous schist, is fully supplied by the appearances on the western shore of the same promontory; and as the examples that occur there *in situ* belong to the upper beds of the series where they are in contact with the superincumbent trap, it is probable that the fragments on the eastern shore have been detached from the same parts of the deposit. While the connexion between the siliceous schist and the chert is here found perfect, the two substances alternating as the limestone and the shale do in the beds immediately succeeding, we can also trace among the different examples a perfect series of transition from the natural to the indurated state. This is perhaps most striking in the shale, which passes by imperceptible degrees into the most perfect Lydian stone. In the case of the chert there is less regularity, but the difference is easily explained by attending to the composition of the original limestone beds. Where these have been tolerably pure, they seem incapable of undergoing any change but that of crystallization; where the other earths have been in excess, they are converted into cherts of various degrees of hardness, in which the calcareous ingredient can no longer be detected by the ordinary methods; the several earths having combined, as in the case of pottery, into a substance not unaptly to be compared to it and requiring methods of analysis equally powerful. In all the specimens of the shale and Lydian stone, shells are occasionally found. Mr. Pennant mentions ammonitæ: I have only observed minute bivalves, their shells being very thin, but the forms so nearly obliterated that it is impossible to conjecture even their affinities. They are never abundant, but I may remark that they are rare in this part of the series, even among the unaltered strata.

Although in some instances the actual contact of the trap with these indurated strata is here to be seen, it is not always found, apparently in consequence of the degradation of the rocks; but one very perfect and satisfactory example occurs in the mass of rock under Duntulm Castle; in which also it is evident that the influence of the trap extends through a considerable space from the immediate contact.* That influence is however palpably variable in extent; a circumstance not difficult to explain when we consider the relatively variable bulks of the stratified and of the interfering rock, and the other numerous variations to which their connexion may have been subject.

The strata in question form a mass, of which the base is covered by fragments, but the visible thickness is about twelve or fifteen feet. It is surrounded on all sides by the mass of obscurely columnar trap under which it lies, the junction being in many places attended with great confusion. The upper strata alternate with similarly thin beds of an indurated sandstone, the whole precisely resembling those alternations of shale and sandstone which occur along this shore. It is not indeed till fragments of the rock are examined in the hand, that the spectator can imagine he sees any thing but a bed of shale alternating with sandstone: but on thus examining the schist, it is found to be an extremely brittle and hard substance, of a black colour, giving fire freely with steel, sharp in the fragments, and with an obscurely rhomboidal fracture combined with the conchoidal; this last character being the only one by which it can be distinguished from the fine grained basalts, particularly from those which occur in the form of veins in the Cuchullin. The sandstone laminæ possess at the same time the hardness and jaspideous aspect of that which I have described in the Geological Transactions as lying in contact with the greenstone of Stirling Castle. Considering therefore the analogy of these two sandstones both in aspect and position, we may fairly conclude that they have in both these instances been altered from their original texture, in consequence of the proximity of the trap rock. The alternation of the two substances here described, which have doubtless been originally shale and sandstone, similar to the unchanged specimens occurring in various parts of this shore, gives us an equal right to conclude that the same influence of the neighbouring trap which converted the sandstone into its present form, also converted the shale into Lydian stone. The position of every specimen of siliceous schist or Lydian stone which I have seen in Scotland is analogous to this. In Cruachan, in Rasay, in the Shiant isles, at Talisker, and in Scalpa, it forms beds, in contact with and involved either in granite or in trap, which, from their connexions and positions, appear to have been common clay slate in those cases where it belongs to the primary strata, and shale in those where it forms a constituent of the secondary. It is possible also that the grey varieties of this substance may, in certain cases, have originated from common slate clay, and the Lydian stone from black shale.

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* Plate XVI. fig. 2.

Between this Lydian stone and fine grained basalt there is often no assignable difference of character except that of the large fracture, a circumstance perhaps necessarily resulting from the unaltered stratification of the former. Nor is there any reason to doubt this resemblance, since the same materials under a different form probably compose both rocks. Chemical analysis unfortunately offers no temptation to try this analogy further, since the variable composition of basalts as well as of schist, a variation necessarily arising from the circumstances of their formation, would prevent the possibility of comparing any two specimens even of the same substance. It is interesting to inquire by what power the vicinity of trap operates in influencing the change from shale to Lydian stone, as well as in producing the much better known changes which occur in the sandstone bordering on it. If basalt has been produced by the fusion of beds of slate, the necessary analogy between the Lydian stone and that rock will appear conspicuous, and we have only to consider it as a shale brought into the state of basalt by fusion, without such further disturbance as to destroy its original stratification.

Although both the neighbouring sandstone and alternating shale which have undergone no change from the vicinity of the trap, contain shells, and that they occur in other places in the indurated strata, there are no marks of them in this bed of Lydian stone. They may nevertheless exist, although they escaped my observation. There is little doubt that the instances of basalt containing shells which have so often been described, have been cases analogous to this: the observers, attending to the composition rather than to the disposition of the rock, having easily been led into error from the perfect similarity of the indurated shale to fine grained basalt.

Before terminating these remarks on siliceous schist I must notice a circumstance apparently of an analogous nature, but the rock being unconnected with any other strata capable of indicating its natural affinity, could not be referred to its proper place in the preceding description. It consists in some beds of quartz that occur in the hill of Greaulan near the northern part of Trotternish. Similar beds have been mentioned in describing Strath, and it is probable that the present owe their origin, like those, to sandstone strata thus altered by the influence of the superincumbent trap; a change similar to that which occurs in the strata at Duntulm.

There is but little to be said respecting the coal of Sky, the position of this mineral being commonly as obscure as its quantity is insignificant. Although a subject of much anxiety to the inhabitants and proprietors, it presents but little to reward the toil of a geologist.

It is found in two distinct positions, in the one case included in trap, in the other interposed among the upper strata already described.

The first example to be mentioned partakes in some measure of both these positions, the stratum, which is little more than an inch in breadth, being interposed between common shale and siliceous schist, and the whole included in trap. It is to be seen between Loch Sligachan and Conurdan.

At Talisker a short and thin bed of coal accompanied by bituminous wood is found entangled in the trap rock, but so high in the cliff as to be scarcely within the reach of examination. On the farm of Scoribreck near Portree it is also found in several places among the trap, but always in an insignificant quantity, and scarcely amenable to investigation: larger masses similar to these occur on the shore at Camiskianevig and in Portree harbour. In these places it lies in irregular nests in the surrounding rock, varying from a quarter of an inch to a foot in thickness. The mass in Portree harbour has been wrought and abandoned, after furnishing, as it is reported, five or six hundred tons. It is said to have reposed on shale, while above, it was in contact with the trap, and to have extended from one foot to three in thickness; but it is now invisible, having been overwhelmed by the fall of the superincumbent rocks. It is still however apparent, that it must have been cut off on both sides by the same mass of trap by which it was covered. The fragments still existing about the spot present much carbonized wood and pyrites, and are accompanied by pieces of bituminous shale.

Similar, but more limited appearances of coal, are found near the head of Loch Grisornish, near Dunvegan, in Strathaird, and in other places; but they are so insignificant in a topographic view and so uninteresting in an economical one, that I shall forbear to point out more of them; particularly as the map will not afford an opportunity to future travellers of discovering them, and the names of the places where they occur defy all the powers of orthography.

The appearances of coal among the stratified rocks are still more trifling, while in most cases they are either overwhelmed or cut off by trap, so that they cannot be pursued for any continuous space. Their thickness rarely extends to a few inches, and they are found alternating dispersedly with shale and sandstone over different parts of the surface of Trotternish. Among other places where they are visible I may name Loch Uig, and the waters of Leolt, Grocheard, and Grimset. Some attempts have been made to examine them in these places, but without attaining more information than is communicated by their casual display. The appearances are both too obscure and too rare to enable the nature and extent of the coal to be ascertained through such a country as this; nor is it likely that any further expense will be bestowed on a pursuit so discouraging. It is probable that wherever this mineral appears, it is like that found among the corresponding strata in Egg, very thin and not persistent; but it is impossible to speak with any decision respecting appearances so vague and unsatisfactory. All economical speculations on this subject are therefore superfluous, since nothing but a regular professional investigation could render the condition of this coal intelligible or determine its value; but it may be remarked in concluding this cursory notice, that the connexion of the strata with the trap, such as it has already been represented, seems sufficient to destroy all hopes of success in working it as an object of profit.

HAVING thus completed the history of the stratified rocks of Sky, I must proceed to the description of the unstratified, of which the general topographic extent has already been sketched.

To assign the places and describe the characters of all the substances that come under this general title would be impossible; so frequent are the changes, so intricate the mixtures of the several rocks, and so undefinable the greater number of the varieties ranked under it. Even if it were possible to define them, neither the geography of the country nor the nature of the map admit of accurate references. But it is still possible to make some distinctions, and it will be useful to make them even where they are unavoidably imperfect. With this view I have attempted to sketch both the characters and the places of the most important or remarkable, omitting others that were of less moment and that defy all arrangement.

In conformity to the most general usage, I have throughout distinguished trap from syenite, even when speaking of them merely in their geological relations; although there is no geological distinction between the two divisions, which pass into each other and possess a common relation to the stratified rocks. For the same reason, porphyry, where it occurs, is also thus distinguished; though more obviously a modification of the same substances that constitute trap and syenite, and in many places indicating its own rank as an accidental variety, by the frequent renewal and alternate absence of the only character by which it differs from the morc simple rocks that constitute its base. Geologists will still consider these three divisions as appertaining to the trap *formation*.

Those who have been engaged in the investigation of this family of rocks must be sensible that the classification above mentioned is imperfect, and founded on improper and insufficient characters. The defect will be principally felt in that division which is known most particularly by the name of trap, and includes many different substances associated by scarcely any bond but colour. The imperfections of nomenclature which result from the transition of different substances into each other, will continue to exist in a certain degree whatever care may hereafter be taken in separating the most remarkable individuals by appropriate names. I shall not here attempt to remedy this defect, sensible of my incapacity for the task; the little I have to offer towards a new arrangement will be better reserved till the other islands similarly constituted have been examined. In the mean time it is impossible to proceed in the description of Sky without giving some account of the different substances included under the form of trap, that will here fall under review; which may be done in the most brief manner.

The first of these is claystone, resembling, in its leading characters and composition, the pale substance more generally known by this name, but differing in the colour, which presents various tints of grey or lead blue; that colour indicating a different state, and at times a different proportion, of the iron that enters into its composition. It occurs in different states of induration, and may occasionally be found passing into the clinkstone, and into the compact felspar of mineralogists; the colour in these cases being neglected as an insufficient ground of distinction. It is necessary to distinguish this substance in its indurated states, from greenstone and from basalt, with both of which it is occasionally confounded. It will be found here to occur principally among the mountainous irregular masses, less abundantly among the stratified, although found in these and also in the form of intersecting veins.

The next substance in the order of comparative simplicity is basalt, a rock as yet but ill defined, if indeed it be capable of strict definition: it will be found to occur almost exclusively among the stratified masses, but sometimes also occupies veins.

I know not if the soft argillaceous substance which is the common base of the amygdaloids in this island will be admitted among the claystones, or whether British mineralogists are inclined to extend the name of wacké to it; since it differs in many particulars from that rock as it is known to the Germans. It differs equally from the claystones in some particulars, and may perhaps for the present be distinguished by the term of indurated clay: an objectionable one, it is true, but capable of serving a temporary purpose. This occurs only among the stratified rocks; and, although generally amygdaloidal, is occasionally simple.

The compound rock best known to mineralogists as a member of this family, is a mixture of felspar and hornblende, the former presenting two distinct characters, the compact and the crystallized: the term of greenstone is sufficient to distinguish it, and it occurs here both in the mountain masses and among the stratified traps. To this compound rock may be added two more, one in which augit, and the other in which hypersthene, occupies the place of hornblende; both of which will hereafter be seen to hold conspicuous positions among the rocks of Sky.

In describing the several members of the unstratified rocks of which I have thus attempted to convey a general idea, I shall commence with the syenite, as there is no motive but that of convenience where there is no natural order.

The general extent of this rock, and that of the mountains composed of it, have already come under review in the account of the face of the country.

The first consideration, in a geological view, is the connexion which it has with the stratified rocks. On the shore near Broadford it is found for a considerable space distinctly incumbent on the limestone and shale of that series. It is in this place disposed in a flat bedded or laminar manner, and the junction is not attended with any alteration in the texture of the stratified rocks, or any disturbance of their ordinary regularity. It is found in the same manner lying on the same rocks, on the hills between Swishnish and Broadford, often very thin and disposed in patches of very limited extent. These are the only decided instances of its superposition and contact together, which I observed; and when it is recollected that this tract is nearly the only one of stratified rock which occurs near to it, we must not be surprised that the contact is not oftener to be seen. It may possibly be found in a similar position at Loch Sligachan, but in that place I observed only a junction of another kind. This consists of a bed of white sandstone found at a considerable elevation in the hill of Glamich, and apparently involved on all sides in the syenite. It may perhaps belong to the next modification, and in that case the sandstone bed is merely cut off on one side by the intrusion of the overlying rock.

The next mode of junction is that where the syenite is found intersecting the body of the strata at some angle, while these terminate abruptly against it, being generally diverted to a certain degree from their natural position. The only instance I shall here quote occurs at Kilbride, and it has been already noticed in speaking of the limestone. It is needless to add to these any other examples to prove this double connexion between the stratified rocks and the syenite, as the same phenomena must have been witnessed, at least in the analogous rocks, by every geologist.

Were it possible to gain access to the numerous junctions which must take place along the irregular line that in Strath separates the syenite from the limestone, many interesting appearances might probably be observed. It would in particular be desirable to know the precise circumstances under which the marble occurs with relation to the syenite; and whether, where this rock intersects, it produces different effects on the strata from those which occur where it merely overlies; a circumstance very remarkable in the instances referred to on the Broadford shore and at Kilbride. But there is no hope of such access, and we must remain content with knowing that the presence of syenite, like that of the common trap rocks, is often attended by a disturbance of the regularity of the adjoining strata, and by changes in their texture; although in some instances no such changes take place. It is superfluous to dwell on that which must have appeared during the examination of the limestone; namely, that the syenitic boundary is very irregular, and is accompanied by detached portions of the calcareous rock.

As the boundary of the syenite is found principally in the tract occupied by these strata, there is little to be said respecting its relations to the red sandstone; since no opportunity offers of investigating these. The junction may possibly be found near Loch Sligachan, where that rock occurs; and it is equally probable that it exists somewhere in the hills near the southern boundary of the limestone, since the syenite appears there to cover the line where the one set of strata succeeds to the other. I had not the good fortune to find it, the hills being much covered with soil and vegetation; but there is no reason to expect any appearances different from those which happen in the case of analogous junctions, or from those already enumerated as occurring in the superior strata.

It is now necessary to inquire into the connexion of the syenite with the other unstratified substances. As all these appear to bear a common relation to the stratified rocks, so they seem to possess a community of position and connexion among each other. In some instances there is a mere gradation; the exclusion of one of the component parts giving rise to a new rock, which in return receiving an addition of some other material, becomes a third; no variation of the great features taking place except that which arises from different degrees of durability, or from those changes of the bedded to the amorphous, or to the columnar forms, which equally occur where there is no change of substance. In other cases there is a decided line of separation, at times connected with a considerable change of composition, at others marked by that change of colour arising from the state or proportions of the iron which, though strictly speaking a change of composition also, is not a radical or important one. In these latter cases the rocks seem to be placed in a disorderly manner, or are mixed together in a kind of lateral alternation. In this way, common greenstone, amygdaloidal claystone, common pale syenite, micaceous syenite, and simple blue claystone, will be found irregularly recurring throughout the whole group; which in the map is marked by one colour only, since any topographic distinction of these variations was impossible. It may nevertheless be added, that syenite under different aspects is by far the predominant rock throughout this region. The hill of Glamich may be quoted as an example of these transitions and mixtures; since it is unnecessary to accumulate instances where few will be inclined to examine them. They are however not unfrequent in that part of the island which is the common boundary of the syenitic mountainous region and the lower country of hilly or of stratified trap; and they may very conveniently be examined at Loch Sligachan, as well as on the shores of the eastern Loch Eynort and of the sound of Scalpa.

A question will naturally arise here; namely, whether there is any difference of age between the several rocks of the unstratified division; whether for example the syenite is of prior or posterior origin to the ordinary trap rocks or to the hypersthene rock of the Cuchullin. If that which is just related respecting the interchanges of the two former be correct, there is no reason to imagine any such differences to exist. Still however, certain portions are to be seen which appear posterior to the main body of stratified trap, and consequently to the syenite; the reasons for which opinion will be better introduced when these shall hereafter come under review. If there be any such difference between the syenite and the rock of the Cuchullin there appears no great prospect of discovering it. Although the former is found within a short distance of the latter, the intermediate space scarcely admits of the necessary examination, nor can the connexion be traced more circuitously through the intervention of the common stratified trap, since the same difficulty occurs in attempting to connect it with that mountain mass. It is true, that while the main body of the syenite is found reposing on the limestone, the hypersthene rock of the Cuchullin lies on the red sandstone at the only place where its junction with the stratified rock is visible. It is thus apparently connected with an older rock; but if the unstratified rocks are throughout of a later date than the stratified, of which the evidence appears unquestionable, this circumstance must be considered as accidental and as incapable of proving any thing respecting their relative periods of formation.*

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* From laying too much stress on these connexions, and from theoretic views of the nature of the unstratified rocks of this family, have arisen distinctions which are often merely nominal, of traps of one or of another age, of first, second, third, and newest *formations*. The same mass will often possess the characters of all these, since it will in one place be found incumbent on the latest, in another on the most ancient rocks. I know not indeed that any certain marks of distinction can be pointed out among the several traps. In the greater number of instances at least which have fallen under my examination, such a relation between an unstratified rock, occupying the irregular and uncertain position which trap does, and those regular strata which maintain a constant order of succession, is by no means a criterion from which to judge of its relative order with regard to these. The aid of a diagram is perhaps required to render this statement intelligible to those who have not examined the rocks. The same mass of trap will for example be found in one place incumbent on clay slate, in another on red sandstone, in a third on limestone, in a fourth on the uppermost secondary strata. In such a case, when the separate portions are either not all accessible, or when they lie far distant and interruptedly, we might be easily led to conclude that they were so many distinct deposits, and thus apply to them terms derived from the particular beds with which they were found immediately in contact. A more intimate acquaintance with such masses, and with the general nature of trap, is required to correct these erroneous conclusions, and the accompanying† sketches will explain that which actually occurs in nature, and of which, if I mistake not, instances are to be found in many situations in Scotland. Cases, doubtless, exist where a real distinction of periods in trap rocks can be proved; but

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† Plate XVIII. fig. 5, 6.

The only other circumstance which can at all be supposed connected with the question of relative antiquity between the syenite and hypersthene rock, is the occurrence of veins of the former substance traversing the latter, an example of which is found in the valley of Coruisk. If this vein could be traced to the mass of syenite it might be held a sufficient ground of judgment, but, under the present circumstances, it is incapable of affording any assistance in solving the difficulty.

Before terminating this account of the transitions of the syenite, I may recall to the reader's mind the small mass of porphyry similar to that of Rasay, which is found on the point of Aird Bhornis opposite to that island, and which, after the account of this rock formerly given, it will be unnecessary further to notice.

The basis of the syenite is a substance which has generally been received as compact felspar. In its softest state it may be considered as a claystone, since it offers no differences of character, while in a state of somewhat greater induration it becomes a clinkstone, and when more hardened is known by the name of compact felspar. As specimens occur here in the simple state, they must be considered mineralogically as examples of these different substances; although in a geological sense they cannot without troublesome circumlocution be described under any but the general term of syenite already adopted. The colour of the base varies from ochrey yellow and obscure flesh colour to grey: it is often cavernous, the cavities being filled with a ferruginous clay. In some situations it contains crystals of felspar, either of the same or of a different colour, and thus forms various kinds of porphyry. The predominant variety however is an aggregate of felspar and hornblende, in which the hornblende generally bears a very small proportion to

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they rest on more satisfactory evidence than that produced by the apparent or even real superposition of an unstratified above a stratified rock.

the other ingredient: the porphyritic character is sometimes superadded to this mixture; while in some rare instances quartz enters into the composition, and it then borders upon syenitic granite. More rarely still it contains mica, and in this case it cannot be distinguished from those granites which contain crystals of hornblende superadded to the usual threefold mixture of quartz, felspar and mica. Under such circumstances it is conceivable that specimens should exist without hornblende, since even in those I have described, it is sometimes very thinly scattered through the mass. In such a case, should it occur, mineralogy, unassisted by geological observation, would tend to mislead us respecting its position; and we are thus compelled to acknowledge, in geological description, the necessity of superadding to mineral characters an accurate knowledge of the connexions of the rocks respecting which we are reasoning.* It is therefore from a geological knowledge of the position of the present rocks, that they are referred to the syenite division, since had the same specimens occurred in a mountain of granite and lying under micaceous schist, they would have been ranked with the granites.†

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* This is far from being the only case in nature where mere mineral distinctions are insufficient to determine the geological situation of a rock. In the stratified rocks, both primary and secondary, these resemblances are frequent; since it is often impossible to distinguish quartz rock from sandstone, the breccias which it contains from the more recent graywacké, ancient clay slate from recent, or, as I have shown in this account of Sky, primary from secondary limestones. The same rocks seem in some cases to have been repeated at different epochas, while in others they show variations which may perhaps be the results of posterior changes operating on the first deposits, rather than the consequences of original differences.

† The character of this syenite gives rise to some conclusions that are not unimportant. At present, it is easily mistaken in hand specimens for a variety of those granites which are entirely subjacent to the older rocks and divested of any pretensions to the overlying character. With a very slight change of composition it could not be distinguished. That such a change occurs in other situations seems

Two other varieties of this rock occur here, which may be mentioned, although possessing no peculiar interest. In the one, chlorite forms a constituent part, and in the other a greenish compact steatite is intermixed with the felspar and hornblende, the total compound being not much unlike the porcelain granite of Cornwall.

It is unnecessary to enter into a minute description of the substances that are connected with the syenite by transition. The general characters of these rocks are well

proved by the observations of Mr. Von Buch in Norway, who has described granite lying on black conchiferous limestone. This granite is, according to that author, connected with porphyry, and there is no reason therefore to doubt that the instance quoted by him is analogous to this; although he has not entered into a full examination of its connexions. His overlying granite will therefore prove, like this, a mere variety, in a geological view, of the syenite and porphyry *formation*; another proof, if such were wanting, of the necessity of great caution in drawing geological inferences from the examination of mere specimens of rocks, and of the absolute necessity of tracing the actual connexions of all those rocks which are subject to similar variations of character.

In the next place, this syenite may serve to prove, that in many other cases, the granites, which we have been accustomed to consider as prior in formation to the secondary strata, if not to the primary schists, may be often posterior to both: the opportunities for ascertaining their relations being wanting; sometimes from the total absence of the secondary rocks in the places where they occur, at others from the impossibility of obtaining sufficient access to them to enable us to ascertain a point of great delicacy and difficulty, and in a third case perhaps from the demolition and disappearance of those portions which may have once been overlying, and have, as being the most limited and the most feebly supported, been removed through a long course of time by the ordinary causes of waste.

It is objected to the well known arguments in favour of the igneous origin of granite, that if it had been protruded from below in a state of fusion it should have flowed over the superincumbent strata: and the non-existence of this fact has been asserted. But the present case, as well as that of Mr. Von Buch, are in reality examples of it, as far as this argument is concerned. It is not necessary that it should always occur. But I have no wish to enter the field of controversy. In the words of Erasmus, "Adeo invisæ mihi sunt discordiæ ut veritas etiam contentiosa displiceat."

known, and the details of their variations are but little instructive. The claystone in its several modifications is commonly simple in composition; being of a dark lead blue, which sometimes assumes a brighter hue, and occasionally passes through various tints to a pale whitish grey or ash colour. In many places it is porphyritic, the porphyries putting on a great variety of aspects, which differ according to the colour of the base, the quality of the felspar that forms the crystals, their magnitude, and the density of their aggregation. Blaven offers a remarkable variety; in which solitary crystals of glassy felspar nearly two inches in length are sparingly disseminated through the ground. The beautiful variety consisting of pure white crystals in a ground of dark blue, which is found at Rasay, occurs also in Glamich. But it would be fruitless to describe more of these modifications. In the same hill it is found of an amygdaloidal texture, but, as far as I have examined, the cavities contain only crystallizations of epidote.

The next great division of the unstratified rocks of Sky comprises the trap, using that term in the sense before defined. It is impossible however to draw a boundary, either in a geological or topographic view, between this and the syenite division already described; the claystone modifications interfering with the whole alike, and being equally incapable of being distinguished in description in the one case as in the other; while they serve at the same time to unite the two by transitions generally insensible. Under these circumstances it would require a volume to detail the whole of the appearances, nor would such a detail be productive of any correspondent instruction; for which reasons I must be content with selecting such parts as present the greatest novelty, or are attended with circumstances of the most general interest. Those who may follow me will find a great deal that is not here described, although little that has not been examined.

The greater part of the tract westward of a line drawn from Loch Brittle to Loch Snizort, consists of these rocks disposed in a bedded or stratified manner, that disposition being easily ascertained by the deep and prolonged sections which the great range of shore presents. In the interior of the country the stratified disposition often ceases, and is replaced by mountainous masses, without any change of composition or any apparent cause for this great change of character. Even in those cases where a decided difference is found between the mountain mass and the stratified one, as, for example, between the hypersthene rock of the Cuchullin and the ordinary trap of Ru an Dunan, it is equally impossible to determine the point where the one disposition ends and the other begins. Similar transitions are of frequent occurrence elsewhere; and, although well known to geologists, no satisfactory explanation of them has yet been proposed.

Of the numerous species of the trap family here existing, basalt is among the most conspicuous, and it occurs almost every where, alternating in an irregular manner with all the other species or varieties. It is most frequently amorphous, displaying at the same time so great a variety both in its natural mode of breaking, in its external appearance on weathering, and in its texture and colour, as to form a great number of subordinate varieties much more remarkable in their natural situations than when broken into hand specimens. At Talisker and in other situations both on the western and eastern shores, it is found perfectly black, and of a very fine grain. Considering the great extent of this rock it is but rarely columnar. The most beautiful and conspicuous collection of this nature at Great Brish Meal has been already mentioned, and ranges of tolerably defined pillars are also to be seen in many places of this neighbourhood occupying elevated situations in the cliffs.

The next most conspicuous variety of trap in this part of Sky is amygdaloidal. I should perhaps in strictness rather have defined this rock by its base than by its structure or accidents; but mineralogical language has no means of distinguishing, not only the infinite difference, but the perpetual variation of the bases which contain these nodules of occasional minerals. It is sufficient to say, that the base varies from the hardness of basalt to nearly the softness of dry clay, and that the colours are black, blueish, brown, dark purple, and grey of different tints, sometimes of a very pale tone. As these varieties often occupy different strata, and are variously intermixed with the solid kinds already described, the strata, when viewed in the cliffs, often seem to possess a diversity of composition which, when examined into, proves fallacious. The nodules imbedded in these amygdaloids are very various, few of all the substances usually met with in the trap rocks being wanting in some part or other of Sky. The zeolites are the most conspicuous, since most of the species are found occupying these cavities, and often in forms so important as to require a separate consideration in the description of individual minerals. Calcareous spar, chlorite, steatite, quartz, chert, chalcedony, and prehnite, occur in other varieties; among which the two latter are most rare. At Talisker, mica is to be observed in some of them, a substance among the least common; and in the vicinity of Scavig, epidote is an ingredient, the rock resembling precisely the specimens from Caer Caradoc.

Many varieties of greenstone are found among the strata in different parts of the island; but they are far less common than the simpler rocks. In some instances the crystallization of the hornblende is very perfect, Basaltic porphyries occur also in different places, but, like the greenstones, they are much inferior in quantity to the uniformly basaltic substances. The felspar is sometimes glassy, at other times opake, and the compound occasionally forms beautiful specimens. Wacké is I believe unknown in this island, although some of the more earthy amygdaloids have been sometimes designated by this term.

The substance known by the name of trap tuff, which I have, for reasons elsewhere assigned, called trap conglomerate, is the last of the varieties which come under this general denomination: no more can indeed be enumerated, since the terms applied to the several members of this family are exhausted. This also occurs every where, and is generally intermixed with the other varieties. No example however was observed of that variety containing rounded nodules and foreign substances which occurs in Canna; the conglomerate in Sky always appearing to consist of a loose mass of angular fragments of gravel and sand, easily mouldering to dust and soil.

It is necessary to add to these, two substances, which although not appertaining to this family, are often found united with it, and rarely, if ever, in any other situation. These are iron-clay, and a particular sort of jasper. They occur separately or together in different places, but are very conspicuous at Talisker. They are extremely irregular in their positions, and discontinuous in their lateral extent. The iron-clay is the most abundant, and forms considerable beds in the cliffs about Talisker, and along that coast as far as Loch Brittle. It is of various colours, red, purple, blue, and grey; these being often very lively, and giving to the cliffs the appearance of having undergone the process of calcination. The jasper is rare. I have used this term because I know of no other by which the substance in question can so well be characterized. It is yellow or brown, with a lustre approaching to the resinous, and is well known as a product of St. Helena. The specimens of Sky differ in no respect from those of that island, which have sometimes, but improperly, been called pitch-stones. That they are not such, if proof were necessary, would be sufficiently proved here by the regular gradation which they undergo into clay;

appearing indeed to be portions of clay which have undergone changes, in consequence of their vicinity to the basalt, resembling those which sandstones experience in similar situations.*

The succession of these several substances is often found in the same place, but their order can never be determined; as, from the cliffs rising to a height of 500 feet or more, they are so far out of reach as to prevent us from forming an accurate judgment respecting the individual parts. It is only by examining the fallen specimens that the varieties in any spot can be ascertained. They seem more numerous from Loch Bracadale to Loch Brittle than elsewhere, but possibly this may arise from the greater facility experienced in examining this line of the coast. The number of strata seem to vary from eight or nine, to twelve, fifteen, or even more; but it is not easy to define their boundaries at the distance from which they must be viewed. The manner in which the several beds decompose often adds a very remarkable feature to the cliffs: some become scoriform, others moulder into large cavernous shapes, while a third set fall to powder; and these various appearances combined with the colours of the iron clay, give to the whole that aspect of having undergone the action of fire which strikes a common observer even more forcibly than a geologist. Besides these, siliceous schists of various kinds occur among the beds of stratified trap, occasionally extending for a considerable space. It is by them indeed that the divisions of the strata appear often to be determined, and they perhaps offer the clue to explain this disposition. It has been shown in describing the siliceous schists of Trotternish that they often resemble basalt in appearance, the difference being only marked by the slaty structure. It was also proved that they were argillaceous schists altered by the influence of the adjoining trap. It is easy to conceive that a further continuation or a greater degree of this influence would obliterate the structure also, and thus convert them into simple stratified basalts. To apply this reasoning to the western cliffs under review, it is only necessary to suppose that the original schistose strata possessed the variety of composition usual in similar cases, and that they have been fused in their places; the different beds undergoing, in consequence, the various changes which produced the differences in the trap strata now visible, and the more infusible having been converted into the siliceous schists that still remain to mark their origin. There are many other cases of stratified trap to which this explanation will apply; and it is further easy to see that it offers a solution of the difficulty before stated respecting the connexion of that variety with the mountainous one.* With this general account I shall close the description of the great north-western portion of Sky, and proceed to the north-eastern part, which presents many interesting appearances.

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* I have since received similar specimens from Guadaloupe, where they occur among the lavas of that island, adding one more to the numerous analogies already existing between the volcanic rocks and those of the trap family.

The trap already described, whether mountainous or stratified, affords no examples, except in the very few instances formerly enumerated, of interference with the secondary rocks, these latter occupying a definite region separated from them by a boundary incapable of deep examination. But in many parts of Trotternish, and principally on the eastern shore, abundant and most interesting examples of this nature occur, exceeding in number and variety all those which have been hitherto enumerated in Scotland.

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* The porphyry which accompanies the coal field of Campbelltown presents a structure very illustrative of this view. Through every part of the mass, fragments of schistose rocks may be observed, varying in dimensions and, in some cases, of considerable extent. It is not difficult to trace the gradual transition by which they pass into the shapeless mass that includes them, while they present those other striking indications of the action of fire which I have described at full length in a paper on the Hill of Kinnoul published in the Geological Transactions. The mixture of schist and trap in this hill is obviously of a similar nature, and equally illustrates the present view.

The character of this trap is also different from that of the western shore. In the latter tract it generally presents a stratified appearance, one substance being succeeded by another, sufficiently different, although of the same family, to cause the line of separation to be visible even from a distance. But here the appearance of stratification does not take place, although the horizontal line which separates the strata from the incumbent trap presents a deceptive appearance of it; while a tendency to the columnar structure is every where to be seen. This tendency is particularly marked at the northern extremity of Trotternish, as well as on its western shore, and extends in a certain degree to the opposite promontory of Vaternish. In a few cases, the most remarkable of which have already been described, the columns attain considerable regularity; yet they are never so perfect as in Staffa, nor are they horizontally jointed as in that island. In some places however the ranges are distinguished by a peculiar feature, a whole series being cut through by one long extended horizontal joint as decided as if it had been made by a knife, while the ends of all the columns above and below it, remain continuous in adaptation and without any marks of displacement.

It is unnecessary to describe the nature of all the rocks over this large space, but the general aspect of them is that of greenstone, varying in the fineness of the admixture, and sometimes assuming the appearance of basalt. Occasionally, amygdaloidal masses are also found, but as no useful information could be conveyed by those details, I shall only notice that variety which occurs in the eastern cliffs already described.

It appears to be a mixture of compact felspar and augit, differing in some respects from that variety of the same rock which is the most conspicuous in Rum, since the felspar in this latter is generally of the crystallized or of the glassy kind. There is reason to believe that this rock is of much more frequent occurrence than has commonly been supposed, and that it is often mistaken for common greenstone; the difficulty of distinguishing between hornblende and augit, when in a state of minute admixture with felspar, being very great, if not insuperable. In the example now under review the investigation is more easy, from its presenting many of those veins known by the name of contemporaneous, which graduate into the surrounding rock and contain large though imperfect crystals of the augit. There is also a certain facility in detecting the nature of the rock when fresh, which is lost in the specimens that have had time to dry. The finer varieties when thus broken are comparatively tender, with the aspect of serpentine, the felspar being of a decided green and the augit of a pitchy black. In a day or two this distinction vanishes, the whole acquiring great additional hardness and an uniform grey colour; in which case it often happens that neither of the constituent parts can be discerned with any degree of certainty.*

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* With others, I have had frequent occasion to notice the soft nature of many rocks and minerals when first taken from the earth, and the changes they undergo on drying, but the case of greenstone or of other rocks of the trap family so circumstanced has not, as far as I know, been remarked. I have observed a similar instance to this in Bute, and do not imagine it to be uncommon. It is probably overlooked, only because the toughness of these rocks commonly renders the mineralogist satisfied with the first superficial fracture that he can obtain. There is no apparent reason why the rocks of this family should not contain water, even admitting their igneous origin; as it is evidently in a very loose state of combination, or it could not so readily be separated by

This rock may without inconvenience be designated by the term augit rock, a name absolutely wanted if, as I have already said, it is found to constitute a principal member of the multifarious family of trap. It is interesting to remark that the characters of the lavas and the traps are thus still further approximated, since the observations of mineralogists have recently proved that augit and not hornblende forms the dark part of these volcanic products.

One circumstance relating to the position of the trap is worthy of remark before proceeding to consider its interference with the stratified rocks. In some places the continuity of the uppermost incumbent stratum is broken; a single patch of columnar rock being found lying on the strata detached from the surrounding parts.* This phenomenon assists in illustrating that much greater loss of substance which in other cases, as in that of Dun Can in Rasay, has left a single eminence of trap insulated on the surface of the subjacent rocks. The great tendency of this substance to decomposition, explains the mode in which the loss of masses so extensive takes place, without the necessity of having recourse to violent causes of denudation. Other similar instances have been noticed in different parts of this work, but I may here point out a very remarkable example on account of its accessible nature. It lies at the north Queen's-ferry, the complete transition from trap to yellow clay being undisturbed; the marks of the rude columns and of the spheroidal crusts by which they have successively decomposed still existing in the clay, though now reduced to powder.

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mere exposure to the atmosphere. The travelling apparatus to which a geologist is limited does not easily admit of the means requisite to ascertain the proportion of water on the spot, where alone it could be determined; and the delay of even a day or two is sufficient to dissipate it, in part or altogether.

* Plate XVII. fig. 3.

The interference of the trap with the strata presents, as I already remarked, every modification that has yet been described. Some of them require a few words, but the greater number will be sufficiently and even better illustrated by the drawings, which have been so selected as to contain the principal details of the whole line of disturbance; the general aspect of larger portions of the coast being given in other sketches taken from a distance where the minor disturbances were invisible.* One of the objects is to show that there is no persistent parallelism between the trap and the stratified rocks, and that the occasional regularity of alternation is deceptive; since by extending the examination we always arrive at some point where that regularity ceases. This fact has often been noticed on a smaller scale; but there is here a display of the whole arrangement on a scale so magnificent and extensive, since it occupies many miles in length, and so free from all chance of error since the sections are as perfect as if made by art, that it would be unpardonable to pass it over.

The instances of fracture, separation, displacement, flexure, and entanglement, are sufficiently visible in the drawings; those of irregularity in the stratified disposition of the trap, require a few words. In one case,† which occurs not far from Holme, there is a bed extending for a great way, surmounted by a parallel series of the secondary strata in contact with it; but on a narrow inspection innumerable veins are seen branching into the strata in every possible direction, illustrating in a very perfect manner the origin of at least one order of veins. In a second case‡ three beds of trap can be traced in a parallel direction for a considerable space, separated by the regular strata, when suddenly the whole unite into one mass. Had not this occurrence at length betrayed the true nature of these beds, there would have been no hesitation, from a limited observation, in describing them as unquestionable instances of alternation. In the last case which I shall enumerate, one regular bed of trap may be traced for more than a mile, lying in a parallel and undisturbed continuity between the secondary rocks. On a sudden however it bends downwards so as to pass through the strata immediately in contact, and then continues to hold its regular course for a space equally great, with a thickness and parallelism as unaltered as before.* I need make no commentary on these several facts since the conclusions that may be deduced from them have long been familiar to geologists.

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* Plate XVII.

† Plate XVII. fig. 2.

‡ Ibid.

But I cannot terminate the account of this most extraordinary and interesting part of Sky, without pointing out that, of which the sketches already referred to will show the details.† It is, that notwithstanding the entangled fragments of the strata, the columnar disposition of the surrounding trap is not affected. That disposition commences to the southward of the nameless cascade already mentioned, and seems to be continued with a persistent regularity to Loch Staffin whether these fragments are present or not; although they are actually more numerous and remarkable here than in any part of the whole line.

Another portion of the trap of the eastern shore which appears worthy of description occurs at Sligachan. In many places, as I have already noticed, the mixture of the ordinary trap with the syenite is frequent, and it appears to take place chiefly near the northern boundary of the latter before this is thoroughly established. These mixtures can therefore be traced along the shores of the sound of Scalpa, the borders of Loch Eynort and of Loch Sligachan, and from the latter point to a short distance in the direction of Portree. In some cases there is a gradation from the best characterized greenstone to the most ordinary syenite, through various shades both of colour and composition; while in others the separate substances lie irregularly intermixed without gradation; the contact of the two being such as not to indicate the relative priority or posteriority of either. The transition, where it exists, is formed by means of a blue compact felspar, which first replacing the yellow felspar of the syenite, is finally converted into greenstone or into augit rock by the acquisition of hornblende or augit.

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* Plate XVII. fig. 1. † Plate XVII. figs. 3, 6, 7, 9, 11, 12, 13, 15.

Among the remaining overlying masses of trap that seem worthy of a distinct notice is that which occurs near Swishnish point, which, though not very extensive, affords an interesting and distinct section of its structure and of its connexions with the subjacent strata, as the accompanying drawing will more fully explain.* Connected with it is one large process or vein an hundred feet or more in thickness, cutting through the strata and lost in the sea, affording an example of the double connexion which trap has with the stratified rocks. At some little distance from this, numerous smaller vertical veins descend in the same manner, cutting through the subjacent strata. This fact illustrates the origin of trap veins, at least in certain cases, even more distinctly than the appearances just mentioned on the eastern coast. It is probable that they are in most instances connected with a principal mass, even where we have not the means of tracing them to their sources; while it may happen in some, that the masses with which they have once been connected, have disappeared in the progress of time, leaving behind those parts only which were protected by the surrounding rocks. The ultimate removal of the overlying trap of Swishnish, a circumstance far from improbable, would thus leave the veins in question remaining independent, and thus perhaps induce future geologists to attribute to a protrusion from below that which may equally have entered from above; though it is not necessary, even for the igneous theory of this rock, that every mass or vein should have originated in the former manner.

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* Plate XIV. fig. 5.

Although the same perfect exposure cannot be obtained, there is reason to think that the trap of Strathaird is similar to this, and is equally the origin of the numerous veins which there intersect the strata.

There is also some reason for supposing that these masses are of more recent origin than those which form the bulk of the island, since the latter do not send forth any such veins, but are on the contrary intersected by veins of a date more recent than themselves. These probably originate in masses now removed, or concealed from view; and as such masses must necessarily, like the veins, be of later date than the rocks in question, it is a natural consequence that there are in Sky two distinct formations of trap. It is not improbable that the rock of Swishnish and Strathaird belongs to the second of these; a question which can only be decided when the veins of Strathaird that intersect the stratified rocks shall also be traced into the rock of Blaven or the other neighbouring mountains. Such a connexion may accidentally be discovered, but the nature of the country is such as scarcely to admit of a regular investigation of this point.

I have remarked in the general description that the Cuchullin mountains are principally formed of a compound to which I have given the name of hypersthene rock. For the sake of the topography it would have been desirable to define the region occupied by this rock; although it is of little consequence in a geological view, since its relations are not required for the purpose of comparing strata or ascertaining their connexions, as if it were a stratified substance: it is little more than a question respecting the proportions of one or of another member of the trap family.

The difficulty of ascertaining its extent arises from the thoroughly inaccessible nature of the eastern declivity of this ridge, and from the almost insuperable obstacles which impede its examination in many other parts; a stormy climate added to the distance from human habitations and the difficulty of access, opposing all investigation. Although I have only named the Cuchullin ridge, this rock is not thus limited, since it extends to the mountain boundary of the eastern side of Loch Coruisk, as will be seen in the accompanying map. There is even reason to suppose that it forms part of Blaven; an opinion founded on the similarity of its craggy outline and the remarkable permanence and nakedness of its rocks, which I have never yet had an opportunity of examining.

Although it forms the principal and fundamental rock of these mountains, it is not the only substance present. Blue felspar porphyry of different aspects, blue claystone, and common greenstone are also to be seen in different places: if we should judge from the fragments of these rocks that are scattered about, their extent would be supposed considerable. But I believe this is one of the fallacies that not uncommonly arise from trusting to the examination of detached fragments. No extent of such rocks can any where be found *in situ*, but veins of them may be seen in many places, whence it is natural to conclude that they are the origin of the fragments in question, being from their inferior hardness more subject to waste than the including rock.

There is nothing more remarkable in the hypersthene rock than its uncommon power in resisting the effects of time and weather; the consequence of which has already been mentioned in the general account of the disposition and features of the island. That durability is exhibited not less remarkably in the condition of the rock on the faces of the mountains, than in the spiry and rugged forms of the summits already mentioned. Detached fragments of it are indeed found, but as they have fallen so they lie, unchanged, no accumulations of sand or gravel from their decomposition being found in the valley; the small and partial deposits of clay that here exist having evidently resulted from the wasting of the soft veins, not from that of the fundamental rock. It is partly owing to this cause, partly to the rapid declivity of the mountains and to the absence of shelves and fissures, that so little vegetation is found in this place. A patch of grass may occasionally be seen where some favourable circumstance has permitted a little gravel to accumulate, but in general it presents one continuous brown surface, not even diversified by a lichen.

The roughness of the surface of this rock is scarcely less remarkable than its nakedness, being comparable to nothing more properly than to a coarse rasp; in consequence of which it is easy to walk or run over those steep declivities which would otherwise be impracticable. This roughness arises from the crystals of hypersthene that project from the compound in consequence of their superior durability to the felspar; undergoing no waste, and often indeed gaining rather than losing brilliancy by the exposure.

If the overlying position of this rock, and its connexion with the other members of the trap family, did not determine its place among these, we should, from its external features and disposition, assign it one with granite, so much does it resemble the rocks of this tribe. It is disposed in huge beds with a convex surface, separated from each other, not so much by the actual presence as by the indications of future fissures; although, in a few instances, these have become sufficiently complete to allow masses to be detached and rolled from their places. Besides the more extended convex beds, large spheroidal concretions are of frequent occurrence; being in some cases so protuberant that half the solid is visible, and their diameters reaching to 50 or even to 100 feet. These are the only modifications of external form visible in this rock, which in no case presents either the flat stratified disposition or the tendency to vertical fracture so common in the members of the trap family; being in every respect, except that of mineral structure, entirely different from the ordinary varieties of this substance. Its granitic aspect is still further displayed in a most striking manner in the spiry forms of the summits, in their hard serrated outline, and their overhanging masses, by which they are rendered inaccessible even to the stags and the wild goats that roam over this region of solitude and rocks. To this is owing their highly picturesque aspect, which bears a striking resemblance to that of the granite hills of Arran, or the more stupendous granitic masses of the Alps. It offers one instance, among a thousand others, of the little dependence to be placed on the characters of the outline in determining the nature of mountains; and shows how easily geologists, who have assumed the certainty of such a criterion and used it in their investigations, have been led to deceive themselves, and have contributed to mislead their readers.

The appearance produced by the fallen fragments is very remarkable, and cannot fail to strike a visitor on his first entrance into the valley of Coruisk. The interval between the borders of the lake and the side of Garsven is strewed with them; the whole, of whatever size, lying on the surface in a state of uniform freshness and integrity, unattended by a single plant or atom of soil, as if they had all but recently fallen in a single shower. The mode in which they lie is no less remarkable. The bottom of the valley is covered with rocky eminences, of which the summits are not only bare but often very narrow, while their declivities are always steep and sometimes perpendicular. Upon these rocks the fragments lie just as on the more level ground, and in positions so extraordinary that it is scarcely possible to conceive how they have risen so high after the rebound, or how they have remained balanced on the very verge of a precipice. One, weighing about ten tons, has become a rocking stone; another, of not less than fifty, stands on the narrow edge of a rock an hundred feet higher than that ground below which must first have met it in the descent. Possibly the presence of snow at the time of the fall may assist in explaining this remarkable appearance.

Although scarcely subject to decomposition, the hypersthene rock shows an occasional tendency to separate in crusts capable of being easily detached, and no wise altered in hardness or integrity. In this respect it resembles some granites, as well as some of the more common members of the trap family.

This rock presents a few varieties of composition, the simplest being predominant and the more compound rare. The most compounded variety consists of hypersthene, glassy felspar, common felspar, and hornblende, and the next differs in the omission of the hornblende. I ought perhaps to add to these minerals oxidulous iron, since it is at times so equally diffused among the other ingredients as to form an integrant part of the rock. This substance indeed often occurs even in the simplest variety, being almost always crystallized in accumulated tetraedrons; while it acquires by exposure a black polished face, being, like the hypersthene, unchangeable, and adding to that roughness which characterizes the weathered surfaces. The simplest varieties consist of a mixture of hypersthene with compact greenish felspar, or with felspar of a crystalline and somewhat glassy aspect. These, from the varying magnitude of the constituent parts, are subject to considerable variety of aspect, the crystals or concretions of hypersthene being in some cases half an inch in length, in others not exceeding in size a pin's point. In this latter case the rock cannot easily be distinguished from a common greenstone, where the fracture is fresh; but the distinction is in general made with great facility on the weathered surface, in consequence of the persistence of the hypersthene. In a few instances the felspar is of a dark purplish hue like that of Labrador, and the appearance of the fresh rock is then still more deceiving, although the same natural analysis almost always discovers its real nature. These several varieties are all irregularly mixed, occurring in close contact in the same continuous mass, occasionally passing into each other, and often disposed in such a tortuous manner as would arise from disturbing a mixture of different tenacious fluids. One rare variety yet remains, especially deserving of notice. In this the crystals of hypersthene are in small compressed prisms, disposed with their flat surfaces parallel to each other and to the general plane of the mass, as mica is in gneiss, and producing the same fissile tendency. Like the mica in the trap of Kerrera and Seil, it may be supposed to throw doubts on the opinion that the fissile property of gneiss, or even of micaceous schist, is the result of mechanical disposition.

As this rock has never hitherto been observed, or else has been confounded with the common varieties of trap, it will be useful to mineralogists to know that it also occurs at Airdnamurchan, and that it forms the supposed greenstone of that promontory. In this place also it contains those veins in which the large concretions of hypersthene are found. It is probable that the rock which produces the same mineral in Labrador is of a similar composition; nor is it unlikely that it will hereafter be found in many places where it has yet been unnoticed, or, as in Airdnamurchan, confounded with other substances.

The hypersthene rock of the Cuchullin is traversed by veins of different kinds, which it will be more useful to describe here than in the section to which the consideration of trap veins is referred.

The first variety of these to be noticed, contains the same ingredients as the including rock, with some occasional additions; but the hypersthene always forms the most conspicuous part. They are generally thin and not persistent, and at the same time pass insensibly into the surrounding mass.

But the most numerous class consists of a blueish grey compact felspar approaching to claystone, very persistent, and intersecting in a decided manner the rock, which occasionally contains marks of fracture and displacement. The veins are of various sizes, most commonly not exceeding one or two feet in breadth, sometimes attaining a much larger dimension, and frequently descending to that of a few inches or even less, while they also ramify into minute branches. They are always conspicuous, from the contrast of their white and weathered surfaces with the black colour of the hypersthene rock. In one of them is presented a beautiful example of the entanglement of the including rock, the fractured and displaced parts admitting of the most accurate readaptation; and as it could not be fully understood by description it is represented in an accompanying drawing.*

In some places, large veins are seen, composed of a very compact hard substance, as sonorous as cast iron. Detached fragments of these are conspicuously strewed on the borders of the Lake Coruisk, being generally honeycombed into deep cavities, but without any mark of rusting or decomposition. The rock is of a pale grey colour and fine grain, with an unusually high specific gravity, and appears to be formed of an intimate mixture of pale augit and compact felspar. Fragments of similar veins are also found studded with protuberant bodies resembling large pedunculated fungi.

Very rarely there occur thin veins of a black substance rather resembling Lydian stone than any variety of basalt, perhaps analogous to pitchstone, and scarcely distinguishable, by the eye alone, from jet. Veins of common grey syenite, not to be distinguished from that which forms the mountains of the middle district, are equally rare; whether ramifications from this mass is a question that has already been considered.

Having thus described as far as appears necessary the overlying trap rocks of Sky, I must now inquire into the apparent effect which they have had in displacing or overwhelming the regular stratified rocks.* In entering on this subject I must necessarily refer again, as on former occasions, to the description of some islands unavoidably placed after Sky in order, namely, Scalpa, Lunga, and Pabba, as well as to Rasay, formerly described.

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* Pl. XXVI. fig. 4.

A line may be drawn in a south-westerly direction from the mainland through the Croulin isles, Scalpa and Sky, to Soa and Rum, marking the course of an elevated set of strata of red sandstone. On the south-eastern side† the boundary of these strata is marked by their contact with the limestone of Scalpa, while on the north-western it is neither so definite nor so regular, but may be traced as far as the southern part of Rasay on one side, and the north-west angle of Rum on the other, beyond which there is no land present to indicate its place. Of the difficulty which exists in assigning the relation of this portion to the limestone eastward of it, I have spoken in the account of Scalpa, to which I must here refer. Whatever that relation may be, it is reasonable to suppose that since these strata bear an accurate resemblance to those of Sleat in direction, in composition, and in relation to the neighbouring rocks, they belong to an equally continuous and regular deposit. It has been seen that those strata maintain an even course till they meet the sea and disappear; and that there is here no rock of the trap family to obscure or disturb them, except the syenite of Ben na Charn, the effect of which will confirm the view of the cause now to be assigned for the interruption of the second or north-western line of red sandstone which may be called the Scalpa line. If now an attempt be made to trace this line, we find it disappear on the eastern coast of Sky, nor does it again come into view until we reach Loch Scavig in this direction, where it is found covered by the trap of the Cuchullin hills; an indication, though a slight one, of its existence below that rock, and of its prolongation beyond the boundaries of the island. Rum and Soa must be considered as belonging to this line; the former presenting a deficiency caused by the superincumbent trap, while in the latter, where that rock does not exist, the beds are regularly persistent throughout.

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* Plate XIV. fig. 1.—Plate XV.

† See the Map of Sky and also the general Map.

On this line therefore, all that portion of the strata of Scalpa which should be found in Sky are missing, with the exception of the very small portion at Scavig above mentioned, and here the chief mass of the Sky mountains lies. If we examine any other portion of the strata we shall find similar although not equal deficiencies, attended by consequent irregularities; all of them, doubtless, equally caused by the trap rocks, the effects of which seem to consist in the overwhelming of some of the strata and the displacement of others; the whole being on a scale so large and distinct as to leave no doubt respecting their nature, and producing a connected train of appearances that cannot be traced in any other place with which I am acquainted. The structure of Arran, in some respects similar, is less obvious, either to the sight or to that species of induction here used; and the phenomena now thus brought under one general view, will perhaps serve hereafter to illustrate other analogous tracts where no industry can draw together the same collective proofs. I shall not attempt to point out the revolutions that must have taken place in these parts of the earth's surface before such effects could have been produced; still less to inquire into causes, in a work intended as a simple record of the physical structure of the places examined, as far as it is possible to give such a record its due value without a certain proportion of theoretic connexion. While the changes are as obvious as their magnitude is striking, it is evident that they have been produced long after the greater part of the materials here forming the surface of the earth had assumed their regular distribution.

I have reserved to the last place the consideration of the trap veins which are found in such abundance throughout this island, because, on account of their number and the interesting circumstances which attend them, their history would have led to a perpetual interruption of that description which required to be unbroken. I have here, as on other occasions, applied to these veins the general term trap, for the reasons assigned in speaking of the rocks of this class, namely, because they vary in composition; although basalt is perhaps the prevalent substance in them. The order allotted for them in this description is also that which they hold in nature, since they traverse every rock that lies in their way, from the most ancient to the most recent; seldom suffering any change either of direction or composition in this varying course. As the same vein is therefore found to pass indiscriminately through rocks of all ages, it is plain that its association with these can afford no register of the period of its formation. If there were ten different periods in which these veins had been formed, we must be contented in most cases to prove but one, namely, a period posterior to that of the latest stratified substance through which they pass. It is only where they interfere with each other that a register more extensive can be found. I have always sought for such examples wherever these veins abound, and, among other places, in Sky, but have never yet traced more than two distinct sets. This number I have also observed in Rum. Both are perfectly visible near Loch Scavig and at Strathaird; and the examples are unquestionable, since those of one period hold their course through the other in every direction, with the same pertinacity and distinctness as the first do through the fundamental rocks. We have no means of knowing what distance of time has intervened between these veins. The angle of the courses of both kinds with the horizon is various, but in a very considerable proportion it is vertical or nearly so.

Trap veins, apparently of the first set, are of frequent occurrence in the gneiss of Sleat, and they also abound in the sandstone at Loch Eishort, where they are of considerable size. Here they are readily traced through all the beds as far as the most distant surface of the limestone.

The second set traverse not only the mountain trap but the veins last named, and are therefore of a posterior date to both. They are much smaller, often indeed not exceeding half an inch in breadth, and are composed of an extremely fine and hard black basalt. Even where they exist, they are less abundant than the first, nor are they found in nearly so many situations. They are frequently to be observed passing through the rock at Coruisk, and through the larger veins of Garsven, in the neighbourhood of which latter in particular, they abound. Their compactness and lustre are frequently so great that they approach in appearance to that pitchstone which forms the basis of the beautiful columnar porphyry of Egg. In addition to this feature they are strongly distinguished from the trap veins that traverse the sandstone, by their intimate and almost inseparable union with the body of the rocks in which they lie; whereas the latter are separated with the greatest ease.

The veins which are found in the stratified trap are not very abundant, but may be seen distinctly among other places on the western shore; traversing the lofty cliffs in various, but generally perpendicular directions, of a very large size, and frequently of a stratified structure. They do not resemble in composition those of the second rank, just mentioned.

As no useful purpose could be served by describing all the individual examples that abound in this island, I shall pass over many which offer no interesting features in themselves, and are of no value in geological science; limiting myself to a few which present appearances the most worthy of note.

Those of Strathaird are among the first that deserve notice, on account of their extraordinary number, and of some particular appearances by which they are distinguished. I have already slightly mentioned them in the general description of this coast, but must now be more particular, and, to give an idea of their general appearance, have subjoined what must rather be considered as a plan than a drawing, since the extent and nature of the subject admit of nothing else.* I formerly noticed their extraordinary numbers, and may now add that in consequence of their frequency, they in some places nearly equal, when collectively measured, the stratified rock through which they pass. Six or eight sometimes occur in the space of fifty yards, their collective dimensions being apparently not less than sixty or seventy feet. This remark is not mere matter of curiosity, since, as will presently be seen, it leads to geological inferences not unworthy of regard. Their direction is almost invariably either vertical or slightly inclined from the perpendicular, and they present therefore a nearly regular parallelism along the coast. Each vein is of equal size throughout its visible course, and without ramifications; and although they vary from five feet to twenty in breadth, they more commonly do not exceed ten. It is well known that the permanence of trap veins is sometimes less, at others greater than that of the surrounding rocks. Hence they sometimes project like walls, while at others their ruin produces fissures or caves. This latter effect has taken place here, marking their great tendency to decomposition, since the including rocks do not seem to be of a very durable nature. The depth to which they have been excavated is often very considerable: in the case of the Spar cave, including the external fissure, it cannot be less than 250 feet. In consequence of this wasting, the intermediate cliffs which remain, have, as I have noticed in the general description, the appearance of the ends of walls; and as they sometimes yield and fall away behind, they present in such cases the appearance of insulated square pillars of masonry; the resemblance being rendered perfect by the channelled marks of the strata formerly described. These veins are often stratified, or more properly speaking, laminated in the direction of their length. They are generally formed of a blueish black basalt: at times they are porphyritic, or vary in other ways which it is unnecessary to describe. I observed in one of them nodules of prehnite, the only occasion on which I have found that mineral in veins of trap. In another a second vein is seen, holding a serpentine course through the first in a somewhat parallel direction, and readily distinguished by being formed of a much more black, durable and compact basalt: it is represented in the accompanying sketch.*

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* Plate XVI. fig. 1.

The peculiar circumstances and extraordinary number of these veins induced me to follow them where they should be expected to reappear. As a preliminary to this attempt it would have been desirable to find their true bearings; but the want of parallelism in their courses, and the deviations from a rectilinear direction, rendered this attempt abortive. They appear however to possess an average common bearing, crossing the line of the coast obliquely, with a general tendency to the northward of west. In attempting to trace them in this direction they disappear in the superincumbent trap, none being found on the western side of the promontory. Hence it is probable that they are all branches from that mass, a circumstance in some measure confirmed by the appearances at Swishnish point formerly described. On examining the opposed shore of Sleat, in which trap veins also occur, they are found sparingly dispersed towards the point of that promontory, and still more rarely to the northward of Ord. But at an intermediate part of this coast, and principally in the vicinity of Tarskavig, they are very numerous, and nearly as frequent for a short space as on the shore of Strathaird. Whether or not these are to be considered as prolongations of the former, it is impossible to determine; although they are probably the same.

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* Plate XVIII. fig. 1.

The courses of trap veins are frequently attended by disturbances in the including strata, but the present instance affords a remarkable exception. Although so numerous in Strathaird, no disturbance occurs in the sandstone beds; their regularity being the same in the upper parts of the coast where the veins abound, as near its southern extremity where they are nearly altogether absent. Perhaps their absence at this place may be considered as strengthening the notion that they originate in the superincumbent trap, which does not extend towards the end of the promontory. Although no particular induration or change of texture occurs immediately at the contact of the veins with the strata, yet it must be remembered that the whole mass is of a hard quality where the veins abound, and of the usual soft texture where they are wanting.

Before quitting this subject it is necessary to point out one extraordinary effect that must have resulted from the intrusion of these veins. Whatever proportion, collectively taken, they may bear in breadth to the lateral dimension of the strata which they intersect, it is plain that the whole mass of strata must have undergone a lateral extension equal to that quantity; a motion so great as not to be easily reconciled with the present regularity of the whole. It is also a singular circumstance, that on the opposed shore of Sleat a different effect takes place, and proportioned, it would here seem, to the number of the veins; the red sandstone strata of this coast being often turned from a slightly inclined into a vertical direction, with other considerable marks of disturbance. It is impossible to account for these apparently capricious differences, and we must for the present be content to rank them among the numerous unexplained appearances in which the science abounds.

Among the trap veins selected for particular remark on account of their interesting peculiarities, two are found traversing the white marble of Strath. They have been cut through in the operation of quarrying and are consequently accessible for a few feet in depth; remaining in so fresh a state as to admit of a clear examination. They enter together into the present excavation, but immediately diverge; in such a manner however, that their contact with the white marble can in many places be accurately followed. Toward the interior part of each, the substance is a black fine grained basalt, which as it approaches the side of the vein, becomes brown or greyish. At the same time its hardness diminishes materially, while its boundary towards the limestone becomes so irregular and uncertain, that it is often difficult to determine the line that separates the two. Various changes here occur, both in the composition of the trap and in that of the limestone. The former, as it becomes softer, is found gradually changed into a substance resembling serpentine, and is intersected by fissures containing laminæ of steatite. Still nearer to the limestone, lumps and more considerable veins of the same mineral occur, lying so confusedly in both that it is difficult to say with which they are most connected. If they graduate into the one they seem equally to pass into the other, while that part of the limestone in which they lie, changes its character, becoming magnesian, argillaceous, or siliceous, and acquiring a great variety of colours. Those of the steatite are various, being pale blueish grey, yellow green, and dark olive green: it is besides various in quality, being sometimes much indurated and at others passing into transparent green serpentine. It is to this substance that the white marble is indebted for the colours that give rise to the numerous ornamental varieties it exhibits.

Here therefore is an example of an intimate connexion between trap and steatite, a fact which is confirmed by a similar occurrence among the veins of Strathaird, the steatite being there disposed in the same manner where the veins intersect the calcareous sandstone. This connexion is attended by a change in the substance of the trap by which it approaches to serpentine; the whole moreover appearing to be connected with the presence of limestone, since the change in question takes place only where those two rocks interfere. As this fact is important in the history of serpentine, a rock of which the natural affinities are but little understood, it may be useful to add that an instance of the same nature, but much more decided, occurs in Perthshire, where a trap vein traverses a mass of limestone in a similar manner. In this case the transition from the trap to the serpentine is very perfect; a line of the latter substance occupying the outer part of the vein while the limestone in contact with it is also filled with steatite.

In describing the limestone of Broadford I formerly remarked that it contained beds of trap, often so equably interstratified as to be generally undistinguishable from regular alternations. An excellent example of their real nature, and of their identity with the analogous appearances in the north-eastern coast of Trotternish, is afforded by a circumstance occurring among similar beds at Borrereg. In one of these the bed, after a very extensive parallel course among the strata of limestone, undergoes a sudden flexure into an oblique position; which shortly becoming vertical, it is then continued beyond reach of investigation under the usual form of a common trap vein; intersecting at right angles in one place the strata to which it was parallel in another.

The last trap vein which appears worthy of specific notice is found near Loch Oransa traversing the gneiss. It is remarkable for the mixture which it presents within itself of all the ordinary varieties of trap: being a fine basalt at the edge and passing by degrees into greenstone, porphyry, and amygdaloid.

I must yet add to this account, the description of a vein for which there is no other place in the arrangement. This consists of a reddish brown compact felspar with a splintery fracture, the fragments being translucent; and it is in some parts slightly porphyritic. The vein is vertical and of considerable thickness, occurring among the sandstone near the Kyle rich.

Among the rocks, for which a place could not be found in the geological description without disturbing its order, pitchstone requires to be noticed. Although not found *in situ* it offers, as a mineral specimen, some appearances which are interesting, and which I shall therefore describe.* The specimens in question were found on the hill of Glamich, and it is probable that they had been detached from veins which I was unable to trace. There are two varieties, one of which is black and very little differing from that of Rum, except that it contains a few dispersed crystals of glassy felspar; the other is olive green, and as it offers some apparently important peculiarities hitherto unobserved, it must be described more fully.

This variety presents a granular, combined with a small conchoidal fracture, and is generally disposed in distinct concretions, which are either of the flat or curved lamellar form. It is remarkable for containing irregular rounded cavities similar to those of the amygdaloids, filled with compact grains of a greyish hue. The structure of these is so singular as to be deserving of notice. On breaking the smaller nodules they are discovered to consist of a greyish white enamel similar to that which is formed by the fusion of felspar. But in the larger, the centre is composed of glassy felspar, the crystalline transparency and platy fracture of which are perfect, while the surface to a certain depth is converted into the white enamel. I have not observed this very peculiar and striking appearance in any other pitchstone which has come under my notice, although there are appearances not much unlike it in some of the varieties found in Arran. In some parts the structure approaches very nearly to that of pearlstone.

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* Loose specimens of pitchstone are also scattered at the foot of Ben na Caillich, and I have just been informed by Professor Jameson that he has this year found the vein in a stream descending from that mountain, where we had both formerly sought for it in vain. 1818.

Those who conceive pitchstone, like basalt, to be of igneous origin, will have little difficulty in explaining this phenomenon, and will even find in it strong evidence in support of that opinion. It is unnecessary to enter on a reasoning so obvious.

I have concluded, perhaps without sufficient evidence, that the pitchstone of Glamich, like that of Ben na Caillich, has been detached from veins. This deduction is made from the small quantity of fragments which are to be found, and from the circumstance that all the pitchstones of Scotland hitherto observed, actually occur in veins. On the side of Garsven I procured a fragment of the same mineral deserving of notice, since it offers an example of a rare occurrence, the transition of pitchstone to basalt. The fragment presents a mass of foliated basalt, the outermost part passing gradually into a fine black pitchstone. From the analogous structure of the vein in Lamlash hereafter described, we are entitled to conclude that this was also the outermost part of the vein.

I SHALL now proceed to describe the minerals which I observed in Sky, having reserved these details for separate consideration, lest they should interrupt the connexion of the geological remarks. The most numerous and interesting of these appertain to the zeolite family. They are to be seen in various parts of the island, but are found in the greatest beauty and variety in the cliffs of the western shore, between Loch Bracadale and Loch Brittle. Talisker, which is the most accessible of these places, presents the richest assortment to the collector of specimens. But in general the mineralogist can have no access to any specimens but those which fall from the cliffs and have long been exposed to the violence of the sea and the injuries of the air. However splendid therefore they may once have been, they are not always to be found in a state of good preservation. It is moreover often difficult to gain access to them on any terms, particularly along the other points of this wild shore; since it is so beset with rocks on which a dangerous surf is almost always breaking, that it requires neither common good weather, nor common dexterity in the management of a boat, to effect a landing and retreat without hazard.

Analcime is the most common of all these minerals on the shore to which I have now alluded, and is found in the greatest profusion at Talisker. It sometimes occupies cavities of considerable size, in different varieties of the trap, but seems to be far most abundant in the earthy kinds formerly mentioned for which there is no name in our catalogue of terms. Occasionally it forms flat druses of considerable extent, occupying the sides of fissures, while in other cases, a single crystal is sometimes found in a cavity just sufficient to contain it. In the greater number of instances the remaining part of such cavities is filled with the filamentous nadelstein hereafter to be described; and the crystals seem thus to be imbedded in a mass of cotton.

The size of the crystals varies from that of a pin's head to the diameter of half an inch; but in general they present only one modification, the twenty-four sided crystal with trapezoidal faces, of greater or less regularity. The only other form which I found was the primitive, and of that I procured but two specimens, while the trapezoidal variety is abundant. The crystals described are sometimes opaque and white, at others they are mottled with a mixture of opaque and transparent parts, while in a third, but less common case, they are transparent.

In this latter state, when minute, they sometimes transmit the black colour of the subjacent basalt to which they adhere, so perfectly as to present a velvety surface of black crystals. In similar circumstances, transmitting the greyish or ochrey tint of the substance to which they are attached, they appear to possess a colour which a more narrow inspection shows to be fallacious. A few specimens occur of a flesh red, a colour frequent in almost all the minerals of this family, and very predominant in the different zeolites which are found at Glen Farg in Perthshire. I also observed a solitary specimen of a pale sea green hue, and I may add that a brick red variety, but uncrystallized, occurs in the amygdoidal rock near Loch Brittle.

Chabasite is found in similar circumstances on the same shore, but is comparatively of very rare occurrence: it is common however in the rocks at the Storr, which for a considerable space consist of an amygdaloid containing this substance accompanied by stilbite. It is here so abundant, occupying cavities of greater or less magnitude, as to form a considerable part of the total bulk of the rock.

As far as I have observed, this mineral is never, like the analcime, imbedded in the filamentous nadelstein, but it is not unfrequently associated in the same cavity both with stilbite and with analcime; nor is it unusual to find minute and well formed crystals of this latter substance, imbedded in the crystal of chabasite. In some cases perfect crystals of chabasite are lightly sprinkled over the surfaces of crystals of stilbite, adhering so slightly as to fall off on the slightest concussion: in others, crystals of this mineral, as well as of the analcime, are confusedly mixed with the rhomboids of carbonate of lime hereafter to be described.

The primitive crystal is by much the most common, the modifications being rare and offering few varieties; but it is very frequently twinned, the angles of the one crystal appearing on the faces of the other: nor is it uncommon to meet with it in triplets, or even in more complicated groups, displaying an irregular mixture of prominent angles. The most common modification consists in the truncation of one angle; sometimes two neighbouring angles are truncated, and occasionally this defect extends to three, the truncations being often so deep as to remove a third part of the rhomb. In other modifications a single angle and a single edge are removed, or the truncations extend to two angles and two edges; but I did not observe any specimens in which these defects were extended to a greater number of edges. The edge is in some cases replaced by two or by three planes, or even by a greater number, so as to appear nearly rounded; and each face of the rhomb is also frequently replaced by two planes meeting in an edge diagonally extended and sometimes rising by successive stages of planes parallel to the original face.

These crystals are sometimes opaque, more frequently transparent, but in by far the greater number of instances they acquire a fallacious aspect of opacity in consequence of innumerable minute fractures by which they are pervaded throughout. They are most commonly white, but the flesh coloured variety is also found, and their magnitude varies from a twentieth to three tenths of an inch in breadth.

Stilbite is the most abundant of the zeolitic substances in Sky, and is also the most generally diffused throughout the island; it occurs along the shore which I have just described, but in less quantity than in the northern district. It is so common in the parishes of Kilmuir and Snizort that the roads are sometimes almost made of it. In other situations the decomposed trap falling into a powdery soil, leaves large accumulations of this mineral resisting the action of the weather long after the rock has mouldered away, while it has in other instances been converted into a friable mass, so as to be mistaken for marle and used as manure.

It presents scarcely any varieties of crystallization: the predominant, I might almost add the universal form, is that most common one consisting of very flat tetraedral prisms, terminating in tetraedral pyramids, of which the faces are placed on the edges of the prism. These are aggregated in distinct fasciculi, parallel or divergent, of which the groups sometimes affect the form of the constituent crystals.

In the neighbourhood of Loch Eynort nodules of great size occur, of a variety which is far from common, but which has I believe been found in the Faroe islands. These are either hollow or solid, and sometimes reach the enormous dimension of four and even five feet. The hollow specimens are crystallized within, in the fasciculated forms already described. The peculiarity of this variety consists in its extreme frangibility: the least effort is sufficient to detach the plates of which it is formed, and it therefore falls to pieces in the very act of procuring it, unless great care is taken; the fracture is distinguished by an uncommon degree of the pearly lustre so characteristic of this mineral. So great is the frangibility, that the jarring of the hammer at one end of a large nodule is often sufficient to destroy the whole; and it not unfrequently happens that when a large piece is obtained entire and has been laid down, although appearing uninjured and resisting a strong effort of the hands to break it, yet in a few minutes it falls to pieces with a violence not unlike that which is known to happen in unannealed glass that has received an injury. This variety is sometimes white, and much resembling spermaceti in aspect, but in the greater number of instances it is of a delicate flesh colour. I may add to this enumeration that I procured at Talisker a few specimens presenting the primitive form of this mineral.

The next of these minerals is nadelstein, which is found in three states, a compact, a mealy, and a crystallized form. Of these, the compact kinds sometimes recede so far in character from the mineral in its most acknowledged forms, that the names of those which occupy the distant points of this range can only be determined by tracing the gradation of the several varieties. The opaque whiteness, the toughness, and the radiated disposition of those which may be considered as forming the first remove, serve to connect them with the best characterized specimens. By a series of gradations the radiated structure disappears, while the mineral acquires additional toughness, verging in aspect first to chalcedony, and lastly towards chert; while in some cases it would be difficult to distinguish it, without trial of its hardness, from the white limestone of Ireland. In this state it is not scratched by hard steel, while its toughness is such that a heavy hammer makes no more impression on it than it would on a similar mass of iron. Where the transition into chert is most complete it is scarcely to be distinguished from those cherts which in other situations occur in trap, and are so frequently to be seen in those traps where nodules of calcareous spar and of chalcedony are found together. Lastly it passes into pure quartz, although there is often a slight boundary discernible between this mineral and the chert that preceded it.

The causes of this gradual change may be attributed to the successive diminution of the proportions which the other constituent earths of this mineral bear to the silica which it contains. I need not point out the difficulty of reconciling such a supposition to the general theory of mineral species and of definite proportions, since mineralogists are already aware of it, and since many similar cases, attended by the same difficulties, are well known. It is a question too important to be discussed without much more numerous and better established facts than those which we yet possess, and it will hereafter become an object of serious investigation to mineralogists, when their science shall have made further progress.

The mealy variety occurs under different aspects, by which its nature is in some measure illustrated. This condition has, I believe, been generally attributed to the loss of its water of crystallization, the result of decomposition. It is obvious however that this is not the cause, since the specimens of this variety are found in the centre of solid nodules of the glassy or compact kinds, where neither air nor water can have access, and where they are accompanied by crystals of absolute transparency: they are also found intermixed with and investing solid nodules of the toughest varieties, deeply imbedded in large masses of rock where the elements are effectually excluded from them. There are three principal forms of this variety. In the first it is disposed in a radiated or rather in a ramose manner, in fine fibres possessing the peculiar lustre and softness of the finest white pulverulent talc. In a second case it forms distinct globular concretions of extreme minuteness, not to be discovered without the aid of the lens; and in a third instance, which I observed near Loch Eynort, a mass of globules of solid radiated nadelstein, very much resembling some of the oolites, is intermixed throughout with farinaceous scales of the same substance having the greasy aspect and lustre already described.

In speaking of this latter variety I have ranked it with nadelstein: it appears to have been formerly placed with the mesotypes, partly because it is found associated with them, and partly because of the theoretical views which have been held respecting its origin. It will be for mineralogists of more authority to consider whether it does not deserve a separate place as a species: the question is not of a nature to be determined by geometrical analysis, as far at least as the varieties already found extend; and the delicacy and uncertainty of unassisted chemical analysis in questions of this nature, are far too great to tempt us to seek a new place for it by this species of investigation.

The last variety exhibits a distinct crystallization; but crystals of tangible magnitude are so rare that I only procured one specimen in which the forms could be determined. It is unnecessary to describe these as they are well known to mineralogists.

To compensate for the deficiency of large crystals of this substance, a profusion of that variety is to be found, which bears a general resemblance to amianthus: it is popularly known in the country by the name of cotton stone. These filaments occupy the cavities of the trap, and are sometimes accompanied by analcime, as was already remarked. They vary much in minuteness and delicacy, as well as in their state of aggregation, and hence many variations in their external aspect may be observed. At times they are placed in distinct straight needles, in other cases they are crowded into a dense mass, while in a third they are so entangled as to resemble a lock of cotton wool. Frequently they have the lustre of common silk, with its apparent dimensions, while they are in some instances so far attenuated as to resemble the silk of certain spiders. When the trap has fallen into powder, they are occasionally detached in light compacted balls, which are blown away by the winds and float on the surface of the water: in all these cases the microscope discovers their glassy transparency, but its powers are insufficient to determine their form, from the dazzling play of reflected and refracted light which they exhibit. In some rare instances this variety seems as if it passed into the mealy; in reality it becomes opaque and puts on a mealy aspect to the naked eye; but this is readily distinguished by the lens from the specimens which I have described above. The last specimens in point of structure which require notice, are radiated and intermixed with crystals of hornblende, producing a compound of an unusual appearance.

The specimens thus described are almost invariably colourless and transparent, or white; but occasionally they assume a brown tinge. One specimen occurred of a sea green hue and of perfect transparency; but the flesh colour not uncommon in this mineral was not observed, although found in the other members of this family which are here seen.

With respect to the exact locality of this substance, I have only found it at Talisker and at Dunvegan, although it is probable that it exists in many other parts of this extensive island, which the labour of years would scarcely suffice to examine with the scrupulosity necessary for this purpose.

In the spot already quoted between Loch Eynort and Loch Brittle, I also found laumonite, one of the least common of the zeolite family. It is occasionally mixed with stilbite, and appears also to exist in the amygdaloids, in which cases it seems to determine or accelerate their decomposition. But it is also found in large masses on the shore, mixed with irregular crystals of calcareous spar, and containing cavities in which it is crystallized at liberty in distinct and perfect forms. These masses attain to twenty pounds in weight, and though now, while at rest, in a state of apparent integrity, they crumble to pieces on the slightest effort to move them. The weather appears to exert no other action on them, since the mineral possesses its snowy whiteness and brilliancy equally on the exposed surfaces as in the interior. Their present state offers a singular contrast to their former one; since they must have been in a far different condition to bear the fall from the high cliffs whence they have been detached, without entire destruction.

In the same fertile spot to the mineralogist I also found the no less rare substance ichthyophthalmite. It is not abundant, but to compensate this, the crystals are perfect and of great size, presenting two modifications. In the first the square prism is truncated on all the angles, and being attached by one of its flat sides to the hard mealy zeolite with which it is connected, is exhibited in great perfection, the crystals reaching from half an inch to nearly an inch in length. In this case the extremities possess the pearly lustre that generally attends this mineral. In the other modification the truncation of the angles is such as to produce a pyramid on each extremity of the prism, and in this case they are as transparent as glass, becoming gradually opaque towards the middle and prismatic part of the crystal. Like the other zeolites it occupies cavities in the amygdaloidal or basaltic rock. I may add that I found one solitary crystal of the same substance at Dunvegan.

Olivin, a mineral by no means common in the traps of Scotland, occurs in the same place. It is even here but in small quantity, since it is found but in one block of the many hundreds which strew this shore and have fallen from the cliffs above. The rock that contains it is, like the generality of the amygdaloids in the same place, a black indurated clay. It forms an uniform kind of mixture with this substance, being in the form of irregular grains, but so abundant that when, after exposure to weather, the clay has decayed, the whole seems one mass of olivin.

Prehnite, a mineral so nearly allied to the zeolites, is also found in Sky, but it is far from common, while the specimens are at the same time of trifling magnitude. It occurs in the trap of Portree, and at other points along the eastern shore; as well as at Strathaird, in the trap veins which traverse the sandstone, as I have already mentioned. On the shores opposite to the point of Clachan in Rasay it is found in a rock, which, although not very common, occurs in different parts of the Western islands. This rock is a compound of augite, glassy felspar, and common felspar, the two latter having frequently a greenish hue. Besides the decided nodules of prehnite, the same mineral is intermixed throughout so as to form an integral part of the rock, often passing into mesotype, as it appears to do in other more decided instances. It has been said by Haüy that prehnite has not been found forming an integrant part of rocks; but as a compound of a similar nature occurs in the Kilpatrick hills near Glasgow, an exception must be made in favour of these instances. I may here add, that a corresponding rock may be seen on the opposite coast of Rasay.

It is perhaps superfluous to say that nodules of chalcedony, often hollow and containing crystallized quartz, are occasionally found in the trap rocks of Sky, since they are of such common occurrence in this substance. They must nevertheless be considered rare here, and it is more rare to find them solid like those so common in Scotland. The only specimens I found were near Loch Brittle, and these were of a dull grey colour, zoned, but presenting little variety. The quartz sometimes forms nodules without the investing crust of chalcedony, and the cavities are sometimes, in addition, sprinkled with crystals of stilbite, of analcime, and of chabasite.

Of those mineral substances which are the least frequent in trap rocks, steatite occurs in considerable quantity; it is tender, and always of a greenish dirty hue. It is sometimes found in very small nodules; but in other places, as near Dunvegan and in the parish of Kilmuir, it is so abundant as to have been dug with the intention of exporting it for economical purposes.

I have already mentioned that epidote is found both in the clinkstone and in the trap, but in too small quantities to render any further account of it necessary. It is thus far worthy of notice, as it is one of the few minerals which seems to appertain to rocks of very different characters and periods of formation. I ought also to add that in one place near Loch Scavig it is so intermixed with the trap as to form an integrant part of the rock.

The carbonate of lime to which I alluded when speaking of the chabasite, is found in company with this mineral and with the analcime, occupying along with them cavities in the trap: it presents but one form, that rhomb which is called the inverse, and varies considerably in dimensions: it is sometimes white, but most generally of a honey yellow colour, and in either case is of rare occurrence. Irregular modifications of this variety, of a white colour, are also found accompanying the laumonite, and it is remarkable that the very same variety is found intermixed with the laumonite of Brittany.

The rarest mineral of those which I discovered in Sky is hypersthene. This occurs at Scavig, in the manner already mentioned, the veins being neither numerous, nor large, nor simple in their composition, since they resemble the containing rocks in the different substances of which they are composed. The most prevailing mixture is however that of hypersthene, with a dark felspar resembling that of Labrador in general aspect, but not possessing its iridescence. This felspar is frequently crystallized, but as the crystals are always completely imbedded, nothing further of their form can be discovered than the outline which is displayed by the fracture: together with the dark felspar, white and glassy felspar also occur in the mixture, and the common opaque white variety is sometimes, but more rarely, intermixed with all the other substances. It has been already noticed that these veins are traversed by veins of compact felspar and of basalt, and they are also intersected by veins consisting of common white felspar and quartz, sometimes confusedly intermixed, and at others disposed in the graphic form. This opaque felspar is sometimes distinctly crystallized in cavities. Rarely, mica occurs in the compound, and in one specimen I observed transparent green crystals so minute and so imbedded that their nature could not be ascertained: they have the aspect of olivin. Pyrites is occasionally seen, interspersed among these substances, but is also rare.

The hypersthene presents specimens of great magnitude and beauty, which, although they seem to resist the injuries of time far longer than the accompanying substances, at length also decay and fall into an ochrey powder. Distinct concretions are to be found exhibiting the primitive form, but more generally it is without form, while in many cases it is intermixed with the dark felspar so as to present the graphic character, the crystals of felspar being defined and the hypersthene occupying the interstices.* The lustre of this mineral is always highly metallic, but the specific gravity of the specimens which I examined did not exceed 3,342. The colour is various, being in general of a purplish black, sometimes steel grey, and more rarely of a whitish grey, while it often assumes the hue together with the lustre of polished brass when it has been long exposed to the air.

Near the small island Oransa there is a rocky islet containing actinolite, worthy also of the attention of zoologists, as it abounds with a rare crab, the Portunus corrugatus. It may be traced to the adjoining shore of Sky near Camuscross, as it holds an uniform and parallel course with the gneiss in which it lies. As the beds of this rock are here nearly vertical, it presents the appearance of a vein, the edge alone being visible; and for this it seems to have been mistaken both here and on the opposite shore of the mainland where it occurs in Glen Elg. Nevertheless it is not difficult to discover that it forms a bed in the gneiss, similar to those of hornblende schist which are of such common occurrence here; and it may even be observed in some places passing gradually into that substance. The visible edge is very irregular, the bed being interrupted and split in many places by intruding laminæ of gneiss, while it sometimes also contracts to the breadth of a few inches and again expands to one of as many feet.

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* This circumstance is interesting, as it points out another striking analogy between granite and the rocks of the trap family.

In general the rock presents a confused crystallization of pale green actinolite, the crystals being commonly minute and much entangled together. In a few instances only its texture is larger, the crystals being wider, longer, and placed in more parallel order, so as to give a longitudinal flat platy fracture. It does not any where present the fine fibrous, granular, or minute schistose texture that is seen in the rock of Glen Elg, nor does talc occur among it as in that place. The specimens that are to be procured are therefore comparatively deficient both in beauty and variety. Its passage into hornblende schist appears sometimes to arise from a gradual change in the colour and appearance of the mineral, but most commonly takes place by an intermixture of common black hornblende. Not unfrequently a compound of this latter mineral, black mica, and actinolite, is found intermixed in the bed. The north-east direction of the gneiss has already been pointed out, and it is preserved in the bearing of this rock. It is probably a prolongation of the well known bed of Glen Elg, with which it coincides in position and direction, as nearly as can be ascertained from the nature of the mass. The prolonged rectilinear course of the gneiss is thus confirmed, as well as the persistence of the beds that enter into it: it may hereafter be an object of curiosity to geologists to trace it still further north-eastward from Eilan reoch: I attempted to pursue it in the opposite direction from Camuscross but without success.

It is unnecessary to enter into further details respecting the serpentine and the steatitical substances that accompany the white marble, but I may mention, that, in the quarry of Strath, portions of a calcareous, steatitical, and white laminar matter, are found highly coloured by the red oxide of manganese, forming a mineral of considerable beauty.

In the same place occurs a peculiar quartz deserving description. This forms distinct masses imbedded in the marble, appearing solid in the centre but exfoliating near the surface in crusts, a white steatitical earth being occasionally interposed. Some portions are finely granular, and the whole is of a snowy whiteness. The most remarkable circumstance is its extreme tenderness when first taken from the quarry. Hence the purer parts crumble into sand under the fingers, while those which contain the steatite can be wrought into a tenacious paste. In a few days the whole acquires the usual hardness of similar substances, and the quartz becomes an ordinary granular and saccharine quartz. I have on different occasions mentioned this fact, but this is the first instance in which I had noticed it in quartz.

In the circumstances under which fresh specimens are usually collected it rarely happens that an opportunity is afforded for ascertaining by experiment the quantity of water that in such cases is contained in rocks or minerals, the loss being generally rapid and the fact past investigation before it is possible to weigh them with the requisite care. I cannot therefore pretend to state the proportion of water contained in this quartz, but I have in other situations of greater convenience made the requisite trial on various substances, and always found that proportion remarkable. In the argillaceous rocks, or in rocks of a lax texture, it may be imagined that the water is simply contained among the interstices, although the loss of it would even then scarcely explain the great change of hardness they undergo on drying.* It is unnecessary therefore to detail the results obtained from these experiments, nor from trials with such minerals as tremolite, asbestos, or sahlite, where the water might also be supposed to exist in a detached state among the fibres or laminæ. To avoid any error from this cause, a specimen of compact white quartz was selected from a place recently quarried, in which all the accompanying substances had been found to undergo a sensible loss of weight after some days' removal. As it was free from rifts, the eventual loss could not be supposed to arise from detached water. After careful drying it was exposed in a warm dry atmosphere for four days, and at the end of that time was found to have lost five grains, the previous weight of the specimen having been 2250, a loss amounting to ,022 per cent. I may add that this loss, although so slight, was accompanied by a sensible diminution of the translucent appearance of the surface; which presented, when recent, a watery aspect, but acquired the usual semi-opaque whiteness of common quartz after this operation. I do not imagine that even this loss was the whole which it might have undergone had the experiment been pursued, since the interior parts of so large a specimen and so compact a substance could scarcely have lost their water in so short a time.

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* A very remarkable example of this circumstance sometimes occurs in those veins which occasionally traverse granite, and are well known from presenting the mixed aspect of a fine grained granite and an argil-

We have not as yet had the means of discovering whether the circumstance now mentioned is of a limited nature, or whether it is universally prevalent in rocks. Nor can we therefore determine of what importance it may be either in their chemical or geological history. It

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laceous porphyry. When the rocks are opened in their interior parts by the operation of quarrying, these are often found so soft as to receive the impression of the fingers, but in a few days they acquire the same hardness which they possess in their ordinary state. This occurrence is not uncommon in the extensive quarries of Rubislaw, where the depth of the sections and the rapidity of working enable the mineralogist to obtain access to those parts which have not received the influence of the air.

is true that large tracts of rock are every where found without presenting this appearance of contained water; yet it may still remain a doubt whether their ordinary dry condition is not limited to a certain distance from the surface; as even in the operations of quarrying or mining we can only attain to a moderate depth within that time in which the portions successively exposed would acquire the hard state. Nor indeed have mineralogists paid much attention to a circumstance, which however well known to occur in many familiar instances, has hitherto been overlooked and treated as an accident.*

I may add a few words relating to the marble of Strath, of which the following varieties are the most remarkable.

1. Pure white marble, the fracture intermediate between the granular and small platy.

2. The same with a scarcely discernible shade of grey.

3. The same with variously disposed veins of grey and black, resembling the common veined marble used in architectural ornaments.

4. The same with narrower veins, well defined, and often reticulated with a great semblance of regularity.

5. The same, distinguished, independently of the veins, by a parallel and regular alternation of layers of pure white and greyish white.

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* The fact now noticed presents useful hints with regard to the quarrying of rocks; although well known to workmen, it has not been turned to the uses to which it might have been applied. Antiquaries have been at a loss to account for the works of the ancients in granite, when the use of steel, if not absolutely unknown, was assuredly not general; neither its properties nor the method of making it having been ascertained, so as to render it a common material. As their columns appear to have been wrought in the quarries, it is probable that they took advantage of the natural softness which even granite in this state possesses. To apply the principle to use at present, it would be proper to keep the quarry in a moist state, or, if the blocks must be removed from it before working, to immerse them every night in water; or else, by some other expedient of watering, to prevent them from losing by evaporation their natural moisture until they were finished.

6. White marble variously mottled and veined with grey, yellow, purple, light green, dark green, and black.

The ornamental coloured varieties here described, scarcely yield in beauty to the analogous specimens of ancient marbles, and like many of those in Scotland, they will be found to owe their green and yellow colours to serpentine. This is also the case in Glen Tilt, at Balahulish, and in Iona. But the most obviously valuable variety is the white, which seems to possess most of the qualities requisite for the purposes of statuary. As I have however entered somewhat at large into the economical value and uses of this marble in the paper formerly published in the Geological Transactions, I need here take no further notice of it.

I may terminate this account of the minerals of Sky by mentioning that beds of marle are not unusual in the island. As they are always found in the vicinity of the limestone strata, there can be little doubt respecting their origin, although it is difficult to conjecture the nature of the process by which the calcareous beds undergo this decomposition.

It ought also to be added to this catalogue of minerals, that oxidulous iron is found in thin veins traversing the hypersthene rock, and with that remark I shall now close the account of this very interesting island.*

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* While this sheet was printing, the arrival of some specimens illegally detained at the Custom-house of Leith, compels me to add as a note, an interesting fact respecting the hypersthene rock which should have appeared in the text at page 390. It is not the only blemish due to the same cause. This is the presence of garnets in that rock, in the hill Scuir na Streigh. They are abundant, giving to the specimens a particularly granitic aspect, and like the graphic variety formerly described, adding another strong resemblance to that already existing between granite and hypersthene rock.

SOA.*

In describing the red sandstone which occurs near Loch Scavig in Sky, I had reason to regret that its very limited extent prevented me from decidedly tracing its connexion with the other portions of the same rock. That which is found at Loch Sligachan is almost equally obscure, while no correct judgment can be formed from comparing the directions and dips of masses so small and so far separated from each other. Fortunately the island of Soa offers considerable assistance in throwing light on the portion which is found at Loch Scavig, as that of Scalpa does with respect to the latter. From these islands also we are enabled materially to extend the connexions of this sandstone, and thus to render the history of Sky as satisfactory, at least, in this respect, as it is in the case of the other stratified rocks.

This island is about two miles in length and a mile and a half in breadth, lying about half a mile or more from that shore which forms the foot of Garsven, the southernmost of the Cuchullin hills. It is a low and uneven land of a tolerably continuous elevation, never appearing to exceed four or five hundred feet, and is in general bounded by an abrupt rocky shore; most commonly terminating in perpendicular cliffs which do not however exceed sixty or seventy feet in height. The correspondence of the eastern shore with that of the neighbouring coast of Sky is so striking as to present immediate conviction of their geological continuity; an impression confirmed by finding that it consists of the same materials disposed in a manner precisely similar.

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* See the Map of Sky. The illustration which this island offers respecting the structure of Sky has induced me to describe it here, although in strictness appertaining to the Sandstone islands.

The whole island is formed of that alternation of red sandstone and graywacké schist which has already been sufficiently described in speaking of Sky. Although subject to many local disturbances, the general bearing and dip of the strata are regular throughout the island. They are also entirely conformable to those of the strata in Sky, the direction being towards the north-east and the dip north-westerly; the angle of inclination appearing to lie between twenty and thirty degrees.

There is one remarkable feature in the structure of this sandstone which I did not perceive in Sky: it occurs however in Rasay also, although it was not there mentioned. The beds are split by fissures which divide them into prismatic and cuboidal masses, their angles becoming at length rounded in such a manner, that when viewed in particular directions they have an aspect exactly resembling that of certain granites. The flexures which interfere with the exact inclination of the beds are frequent, although commonly trifling in extent; but it may be remarked generally, that there is no where in this island the same solid continuity of rock that occurs in the first and largest portion of the red sandstone of Sky.

There is nothing particular to remark respecting the composition of this rock. Its general features are those of a red argillaceous sandstone, sometimes inclining to brown or grey, now and then highly indurated and containing distinct grains of felspar. Sandstone schist and conglomerates, commonly of a fine structure, also occur in it; and the argillaceous schist has often that fine texture which, as in Sky, would cause it, in a mineralogical view, to be ranked with clay slate.

Like the opposite shore, it is traversed by trap veins, which however present no phenomena worthy of being recorded.

PABBA.* GUILLEMON.

The flat and fertile island of Pabba is of a roundish figure and about three miles in circumference; lying between Scalpa and the coast of Sky in a direction corresponding in such a manner with that of the limestone beds of Broadford, as to indicate its composition even before it is examined.

It forms a flat table scarcely sixty feet high, the south-eastern side being elevated and abrupt, while the opposed one declines to the water's edge; the whole being surrounded by low reefs of rocks causing a foul shore. Its structure tallies so exactly with that of the analogous points about Broadford, as almost to render a particular description superfluous. It is however necessary to notice it, on account of the aid it offers in connecting the several scattered portions of rock which are found in the neighbouring islands and on the adjacent mainland.

The rocks towards the south-east consist entirely of the micaceous shale already described in speaking of the Broadford strata. This substance is tender and readily acted on by the sea; and although appearing very solid when examined in a mass, is easily split into thin and mouldering laminæ. The dip is only five degrees and is to the N. W., in which respects it also corresponds to the beds at Broadford. Numerous rounded nodules of trap are contained in these beds of shale, being very remarkable in consequence of their superior permanence. They are all decomposed at a certain depth from their surfaces, a change apparently prior to their present position, since it equally exists in those which are deeply imbedded in the surrounding substance. On the western side of the island portions of the other Broadford strata are found; but as they differ in no respect from those already described, it is superfluous to dwell on them; the object of a visit to Pabba being accomplished in the determination of its identity with those strata of Sky with which, from the general disposition of the rocks of that island, it ought to correspond.

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* Pab, stubble. Gaelic. See the Map of Sky.

I may add that the trap veins of this island are particularly conspicuous as well as numerous; the former circumstance arising naturally from their superior permanence when contrasted with the very tender and yielding nature of the shale that encloses them.

I was induced to examine Guillemon from the expectation of finding the limestone which is wanting to connect the neighbouring shore of Scalpa with Pabba. In this I was disappointed, since it proved to be an entire mass of greenstone.

This small island is about forty or fifty feet in height and abrupt all round. The substance of which it is composed corresponds in every respect with the name, since the hornblende and felspar have both a green colour. The predominance of similar rocks on the neighbouring shores of Sky, and their occurrence in Scalpa, leave no doubt respecting the geological connexion and position of this rock; which doubtless reposes on the limestone it has here concealed from view.

LONGA.*

This small island lies to the north-east of Scalpa, and though, like many others noticed in this work, void of interest in itself, becomes important from its connexion with the surrounding tracts, and from affording a visible point in the sea which serves for the mutual approximation of the rocks that compose them.

It appears to be about a mile and a half in circumference, forming an uneven table land which is abrupt all round and about 200 feet in height; being the habitation of sheep and the resort of gulls and cormorants. Its structure and composition are so simple that it may be described in a few words.

It is entirely composed of red sandstone consisting of beds lying in a north-east position and dipping to the north-west; in both of which respects they are conformable to the rocks on the opposite shore of Sky and in the island of Pabba. Occasionally the beds are bent, and separated by wide fissures; while the sea, acting on the softer strata, has excavated many of them into caves similar to those by which quarries are sometimes wrought, and much resembling the entrances of the well known lime quarries of Arran. The strata are also traversed by trap veins, attended, as far as I could perceive, with no unusual appearances.

Comparing the dip and direction of the strata of Longa and those of Pabba, it might be supposed that the former were superior in position to the latter, as well as to those of the corresponding shore of Sky; an improbable circumstance, since this limestone, already ascertained to lie above the red sandstone of the Kyles district, cannot be supposed to alternate with the same rock. As this phenomenon is important and in need of explanation, while the appearances are in themselves insufficient for its elucidation, I shall defer the inquiry till I have examined Scalpa, where the same facts are found in a more approximate and consolidated order.

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* See the Map of Sky, for the elucidation of which this island has also, like Soa, been removed from its appropriate place.

I may conclude this article by mentioning, with the same general views, that the rock Scuir Dearg, lying to the north-west of this island, is also formed of the red sandstone; thus adding another point to the very few from which the general connexion between these islands and the adjoining mainland must be established,

SCALPA.*

The intimate connexion subsisting between this island and the approximate parts of Sky, by means of a strait fordable at low spring tides, and the continuity of its outline with that of the mountains surrounding Loch Eynort, would induce an observer to expect that it was composed of the same syenitic rocks of which they are constituted. It differs however essentially from them, and thus, although little interesting in itself, becomes important in the estimation of a geologist, by throwing light on the general connexion of the stratified rocks throughout all these associated islands.† The map of Scalpa being little better than conjectural, and giving a very imperfect idea either of its form or outline, the following statements must, as in other similar cases, be taken with the requisite allowances.

This island is of an irregularly oval shape and about three miles by two, in extent. It consists of a single mountain with an uneven summit and rounded outlines; displaying much bare rock, yet no where marked by asperities or by continuous rocky faces. At the same time it presents a grassy, or at least a vegetating surface, by which it is strongly distinguished from the neighbouring hills of Sky. Occasionally, low rocks are found on the shore, rising towards the north-east into cliffs of moderate elevation; but the greater part of the island descends by smooth declivities to the sea, particularly towards the Sound; a noted rendezvous of the herring fleet.

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* Scailp, a cave. Gaelic. I may remark here, once for all, that the presence of the Scandinavian terminal a or ey does not vitiate those etymologies derived from the Gaelic, since local names compounded of the two languages are not uncommon in the Western islands. See the Map of Sky.

† Plate XIII. fig. 1.

There is a low tract on the south-eastern shore consisting of limestone alternating with a sandstone and a shale; all so exactly resembling in their general characters those of the eastern shore of Sky, that it is not necessary to enter on a minute account of them. As far as the direction of the strata can be ascertained, it is similar to that which has already been found the prevailing one there, namely, north-easterly; and the dip, being to the westward, is also the same both in quantity and tendency as in the beds of the nearest part of that island; those namely which appear on the shores of Broadford bay.

The animal remains found in these strata differ in some particulars from those which are most conspicuous at Broadford, but whether those differences are more than accidental I am not prepared to say. The absence of any particular shell is no proof that it does not exist in a given bed; as it is notorious, that in the same beds such shells are in some places altogether wanting, while in others they form large accumulations.

I have already noticed that the prevailing shells in the limestone of Strath are gryphites and terebratulæ: ammonitæ are more rare. But in Scalpa, a large pecten is the most common, being in many places so abundant as to form a considerable proportion of the mass. With this are to be seen many shells, which however obscure and difficult to name, are not found, as far as I know, in the Broadford limestone. They bear a general resemblance to the genera cardium and mytilus of living shells, but I procured none sufficiently perfect to admit of a fair investigation. Long cylindrical substances, which are neither belemnites nor madreporites, are also found, but they are also too obscure to admit of description or of comparison with known fossils. Independently of these, are seen other fragments of various shells, much too mutilated to convey any idea of their original structure.

It is obvious on examining the position of these beds, and in comparing them with those of Pabba and with the neighbouring shores of Sky, that they are higher in geological position, and are, the upper beds, of a calcareous deposit, of which the lower are to be seen between Broadford and Lucy. The breadth of the limestone on the north-eastern side of Sky, as far as any regularity can be traced in it, is therefore limited by the latter point on the one hand and by the shore of Scalpa now described on the other. Here it terminates in the sandstone beds which will be presently described; and as these belong to the same extended and regular deposit as those of Sky, this place must be supposed the natural termination of that calcareous tract. It was shown that on the neighbouring shore of that island the deficiency of the limestone is caused by the overlying rocks of syenite and trap which cover it; admitting its edge to be seen in some places, while in others, reaching to the water, they conceal it from view as effectually as the sea itself conceals those portions which, from general considerations, and from the examination of the low rocks in the intermediate channel, must be concluded to exist from Scalpa through Pabba to the opposed shore of Broadford bay. For the same reason we are unable to trace the north-western edge of this calcareous zone towards Loch Scavig, where it should be found, with the same facility that we trace the south-eastern one to Swishnish; the syenite mountains intruding far over its edge into Strath, as the description of that district has already shown. I forbore to examine these relations under the article of Sky, because, without the evidence which Scalpa, Pabba, and the smaller isles give, the proofs were imperfect; but the investigation must be considered as properly appertaining to the description of that island.

Where the limestone series of Scalpa ceases to be visible, the land rises suddenly into the hills already mentioned, which in a general view are formed of red sandstone. Gravelly beaches on the shore and vegetation in the hills prevent the actual junction from being seen;

and even if it should be found by a more careful search, it cannot, from the nature of the ground, be discovered to a depth and with a clearness sufficient to determine satisfactorily the only point for which that knowledge would be valuable, namely, the relative position of the sandstone and limestone. This is a point of considerable importance in taking an extended view of the structure of the west coast of Scotland.

Near the limestone, the dip of the sandstone beds is conformable to it, namely, north-westerly, the direction of the elevated edges of the strata being here, as in the sandstone of Sky, N. E. There is however in this part of the island some difficulty in ascertaining the quantity of the dip, as there is an appearance of fracture and confusion in many places; it is not however greater than the general average so often mentioned, namely, from twenty to forty degrees; and rather seems to approach to the lower than to the higher angles.

Proceeding for some distance to the north-west, the inclination of the strata changes to the reverse, namely, the south-east, the direction continuing the same;* but it is not possible to discover the gradations by which this reversal takes place, as, between the two, there is interposed a mass of syenite which introduces an obscurity into the whole arrangement. The same cause prevents us from tracing the steps by which the sandstone is once more reversed to its original position; which, recurring somewhere about the middle of the island, is afterwards continued in an uniform north-western dip to its furthest extremity. The mineral characters of the beds do not so materially differ from those which occur in Sky as to require a very detailed notice. Such particulars are indeed so often trifling in themselves and so little conducive to the illustration of the science, that I have on many other occasions been induced to omit them, even after forming an accurate series of specimens; the more so, as no idea of them can be communicated by words, and as it would be impossible to give sections, without adopting a magnitude of scale and a multiplicity of engravings inadmissible in a work of this nature.

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* Plate XIII. fig. 1.

The sandstone is sometimes red, while at others it passes into grey and into lead blue. Occasionally it approaches to the schistose structure, the laminæ being determined by interposed scales of mica. The same schist which accompanies the beds formerly described is also found here, and in the same irregular manner; but it appears chiefly to prevail in the lowest part of the mass.

With these and with grey quartzy sandstone, there occur beds of a blackish hard rock of the nature of siliceous schist; usually distinguished by laminæ alternately lighter and darker, and prevailing chiefly in the vicinity of the limestone. Among them are also to be seen portions of that schist which is characterized by the globular structure, and of which examples will hereafter be described in the Shiant isles. As the mode of weathering in this place explains the origin of the projecting globules, it may be briefly described; particularly, as in the instance just alluded to, the same explanatory circumstances do not occur.

In a recently broken specimen there is a perfect uniformity of texture without the least indication of the globular conformation. As the rock begins to weather, it discovers to the depth of an inch or more, grey globular masses imbedded in an ochrey-coloured basis; the two being at first scarcely distinguishable in hardness. By degrees the yellow parts soften and at length are washed away by the sea, while the globular and harder grey parts continue; destined ultimately to project in the botryoidal groups described more fully in speaking of the Shiant isles. It will hereafter appear that the argillaceous porphyry of Arran which undergoes the same changes, is constituted in a similar manner and owes its peculiar appearance to the same process. However unable to explain the causes of this conformation, it must be referred to the concretionary structure; of which, on a larger as well as a smaller scale, there are many examples, no less difficult to understand in the present state of our knowledge respecting minerals.

The only substances remaining to be described in Scalpa are those that appertain to the trap and syenite, which must be considered as intimately connected with the analogous and neighbouring rocks of Sky. The quantity of these is not great, and if they cannot be traced overlying the sandstone in the same precise and distinct manner as in Sky, there is still not the least reason to hesitate in assigning them the same place. They are found both on the summit of one of the highest parts of the ridge, and at the water's edge on the lowest shores. The predominant substance is a dark blueish claystone, either of a very fine and even texture, or passing into a harder matter like greenstone, or porphyritic, or finally losing its dark colour and becoming a simple grey felspar somewhat porphyritic, or else graduating into an ordinary syenite formed of grey felspar with rarely dispersed crystals of greenish hornblende. I need not describe it more minutely, and it is almost superfluous to say that trap veins are found every where throughout the island as they are in all parts of these regions.

I shall now therefore recur to the most interesting question which Scalpa presents, namely the relative position of the limestone and the sandstone: a matter of general interest, since it not only involves the construction of this island, but that of the sandstone islands which lie in its track both to the south-west and north-east; as well as the relations of the strata which occur in the northern parts of Sky and in Rasay.

If the sandstone strata of Scalpa be prolonged in a north-easterly direction, they meet the Croulin islands and the mainland, on both of which the same rocks are seen occupying the same positions; while in the interval they are found with a perfect identity of structure and position, in Longa and in the rock Scuir Dearg.* If again they are prolonged in the opposite direction they meet with the island of Soa and with the shore at Loch Scavig, where the same sandstone also occurs. Still further, the island of Rum presents the same strata; occupying however a breadth transverse to the line of bearing, which includes part of the limestone tract of Sky and that of the neighbouring islands.† The whole may therefore be considered as the interrupted portions of one set of beds; the interruption being partly the result of that depression which admits of the superiority of the sea, and partly arising from the superincumbent syenite; while to both of these causes is possibly added a disturbance connected with the deposition of the syenite and trap, of which there are not wanting other evidences. In the next place it must be remarked that there is a perfect identity in the mineral characters of this line of sandstone and that of the Kyles district of Sky,‡ although they are separated by the calcareous tract; and that the sandstone is of a peculiar character, as has already appeared from the examination of Sky. Lastly it must be recollected that if the island of Rum be admitted into this tract, its breadth will be found to reach nearly from the first portion of the sandstone, or that which is next to the gneiss of Sky, to the second or that which constitutes Soa, Scalpa, the Cronlin isles, and the mainland about Loch Toskig. The blank caused by the sea between Rum and Sky, prevents the connexion from being drawn closer.‖

It is now proper to examine how these facts bear upon the question which concerns the relative positions of the limestone of Scalpa, and consequently that of the limestone of Sky, to the sandstone strata which lie on each side of it.

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* See the Map of Sky.

† See the general Map.

‡ The eastern portion cut off by a line from Lucy to Loch in Daal.

‖ Plate XV.

It has been seen that the calcareous strata, both of Scalpa and Broadford, follow the sandstone of the south-eastern division of Sky with a common dip, and as the limestone of Sky lies on that mass, it is to be presumed that the limestone of Scalpa also bears the same relation to it. But the sandstone which immediately follows the calcareous strata in Scalpa appears to lie above them, since it is higher and has a common dip. And here the evidence of its geological superposition ends, since neither in Sky nor in any of the islands to the south-west is any approximation of the two rocks on the same alignment as these to be discovered. On general principles it is not probable that such an order actually exists, since it would introduce a greater anomaly into geological arrangements than any thing which has yet appeared in the course of these examinations. Further, the identity of structure in the eastern and western portions bespeaks a community of nature, which is still more confirmed by the very peculiar characters they both exhibit. The extent occupied by Rum, which in a manner connects these two branches into one, is a further argument in favour of this view. To conclude this reasoning, it is easy to imagine that the limestone ceases at a certain point to be prolonged on its line of direction, and that it thus forms one of those basin-like deposits in the cavity of the inferior strata, of which abundant examples are not wanting every where.

If the preceding view be correct, it will materially elucidate the structure of Sky, which was left in many points undetermined, till the whole evidence could be collectively stated. Thus the detached portions of sandstone and of limestone at Loch Sligachan, with many of the rocks of Rasay, as well as the upper beds which exist in so scattered a manner in the northern parts of Sky, will find their places in an arrangement from which their irregularity had excluded them when considered in an independent view.

The irregular boundary of the Sky limestone, which I have generally attributed to the syenite, will thus also in some measure appear to depend on the form of the sandstone on which it has been deposited.

I have added to the actual section of Scalpa, as far as it can be made out from external examination, a speculative one,* to explain the manner in which the sandstone and limestone might be connected, on the view which I have here held out; and shall defer any further general remarks to which the subject might give rise, till the remaining islands connected with Sky have been described. I shall only here add, that although the sandstone has been traced to the mainland, the limestone does not there occur, being entirely limited to the islands of this group.

* Plate XIII. fig. 2.

THE SHIANT ISLES.*

These islands are among the few which possess a Gaelic name, those of most of the Western islands being of Scandinavian origin. The term, meaning sacred, was most probably applied to them from their having been at one period a place of eremitical or monastic seclusion,† traces of which seem to exist in the walls of a building, now nearly levelled to its foundation, on Eilan a Kily. These remains are of square masonry laid with lime, and are on too small a scale to have been a castle of strength, or the habitation of a chief. It is indeed recorded that the Shiant isles contained a chapel dedicated to St. Columba, being one among the numerous buildings placed under the protection of this favourite saint; and the ruins in question probably belong to that chapel or to a cell dependent on Iona. The name of the island, "The isle of the monastery," countenances this supposition, and will justify the addition of this ruin to the few fragments of religious antiquity still remaining in the Highlands of Scotland.

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* See the general Map.

† This word is also used, with its congeners, to denote any thing connected with magic or supernatural agency. Its strong resemblance to our word enchant, in sound as well as in meaning, renders it probable that it is the origin, however remote, of that term. It is true that etymologists have derived it from the Latin, and that they have also conceived the Latin term to have proceeded from the use of music or song in the process of incantation. But neither in Theocritus, in Horace, in Lucian, nor in Apuleius, is there any allusion to music as an instrument of magic: the etymology seems purely gratuitous, and, like many others, founded on mere resemblance of sound. The original languages of Italy are more probably its real origin, as they are of the Latin language in general; and through that ancient source, as well as the Greek, we must trace the numerous analogies apparent between the Latin and the Gaelic.

Although the dimensions of these islands render them as insignificant in the general map, as their small extent does in an economical view, they are well worth the attention of the geologist; while the lover of picturesque beauty will here, as in many other parts of the Western islands, be gratified with a display of maritime scenery, combining the regularity of Staffa with the grander features of the coasts of Sky. There are three islands, forming a triangular group; two of them being connected by a neck of rolled pebbles which is, I believe, never covered by the sea. Gariveilan is the northernmost, and is united in the mode just mentioned to Eilan a Kily; while Eilan Wirrey, the easternmost, lies detached about half a mile off. Eilan a Kily, the seat of the ruin above mentioned, is now tenanted by a shepherd, who manages the sheep farm into which the whole group is laid out. The circuit of each of the two largest, Gariveilan, and Eilan a Kily, appears to be about two miles; that of Eilan Wirrey is not above half as much.

They all present a verdant surface, the lower parts and declivities abounding in rich pasture; a common attendant on the trap rocks of these islands.

The altitude of Gariveilan renders it the most conspicuous of the group. This, as I measured it by the barometer, rises to 530 feet. It is divided into two portions; the easternmost, and by far the least, consisting of a long, somewhat flat topped ridge, bounded on each hand by perpendicular cliffs attaining to fifty or sixty feet in height. This is connected by a lower neck with the main part of the island, which forms an irregular rounded hill accessible but in one or two points; even that access being attended with considerable difficulty. The boundary towards the south is the lowest, as it does not in some places exceed the height of thirty feet; but there, as almost every where else, it presents a vertical face of imperfectly columnar trap. At the east side it descends by irregular stages of columns, sometimes remaining in their natural positions, at others fallen and intermingled with steep and impracticable grassy slopes. Towards the north it exhibits one continuous perpendicular face of naked rock; which, at the eastern end, terminates in the sea that washes its foot, while, toward the western, its base is concealed by a great accumulation of earth and fallen fragments. This face, measured by the sounding line, was found to vary from three to four hundred feet in height. It is columnar throughout, and forms a magnificent scene for the pencil; spreading in a gentle curve for a space of 1000 yards or more, and impending in one broad mass of shadow over the dark sea that washes its base. In simplicity and grandeur of effect it exceeds Staffa almost as much as it does in magnitude; offering to the tourist an object as worthy of his pursuit as that celebrated island, and of no very difficult access from the northern extremity of Sky. Although the columns which form this extensive and elevated face, are scarcely less regular when separately considered, or when detached, than those of Staffa, they do not impress the spectator with the same idea of regularity, or excite the same feeling of artifice. Different causes unite to prevent this. One of these is the want of that contrast which in Staffa results from the irregular masses of rock on which the pillars repose and which at the same time surmount them. Another cause is to be found in the great height of the columns composing this face, which, being prolonged from the sea to the very summit, exceed six times in length those of Staffa, while they do not generally surpass them in dimension. They consequently appear small; while the distance required for viewing the whole to advantage, diminishes them still so much more, as almost to render the columnar structure of the cliff invisible from a proper point of sight. Lastly, the great length of these columns generally prevents them from being continuous, as at Staffa, from the summit to the base; and the effect of regularity is therefore diminished by the interruptions which result from frequent fractures. But these are rather sources of variety than defects; and if the faces of Gariveilan have less of design and regularity than those of Staffa, they exceed them in simplicity, in grandeur, in depth of shadow, and in that repose which is essential to the great style in landscape.

Numerous points of view occur in sailing round these islands; scarcely less fine than that now described, and much varied according to the positions of the several islands and the groups which they form with each other and with the projecting point of Gariveilan; which often combines with them so as to produce foregrounds of great beauty and striking character. This point is formed of irregular trap, having nothing of the columnar form, but presenting a highly picturesque appearance. It affords one scene of considerable interest in itself and productive of great effect; being perforated by an irregular arched passage from thirty to forty feet in breadth, and of similar or greater altitude, supported at one end by two detached columns of rock, and apparently from eighty to 100 feet in length. A turbulent sea roaring through it carried the boat with such fearful velocity that I could form no better estimate of its dimensions, nor, unfortunately, any more permanent record of its picturesque and extraordinary appearance.

Eilan a Kily differs considerably in shape from the former, descending by a low rocky shore on the western side, and being bounded to the east by columnar faces of more or less regularity, but not attaining half the height of those in Gariveilan; while the effect which they might otherwise produce is obscured by the superior grandeur of this object. Eilan Wirrey is still less regular than Eilan a Kily; while the length of its columnar portions are further diminished by a thick substratum of horizontal rocks on which they lie. The shore is skirted in some parts by huge detached fragments of the island, which have slid from it into the sea, and are so little altered by this violent change, that the imagination easily refits them to their original places.

The columns which compose these islands vary somewhat in size as they do in the number of their angles, and five feet may perhaps be reckoned an average diameter. It is not uncommon however to find them in Gariveilan reaching to six or seven feet, and I measured an heptagonal one which was eight feet six inches in diameter. On this island there is one small range regularly jointed at short intervals and at right angles; but in other parts they are jointed, or perhaps rather split, at very oblique angles. In their general character however they are free from joints; notwithstanding which they usually break at right angles to their length; and the fragments, which form immense heaps at their bases, are therefore of very regular shapes. Like Ailsa and St. Kilda, these cliffs are tenanted by myriads of puffins and other sea birds, which in the breeding season almost deafen the spectator with their ceaseless clamour, and darken the air with their flight, reminding him of the lively description of Virgil.

The columns which have been described consist of one of those varieties of trap often confounded under the term greenstone. It is however a variety of augit rock, and is very like to that occurring at the northern extremity of Sky, with which it also corresponds in its connexion with the secondary strata. Its most usual aspect is that of a distinctly visible mixture of whitish felspar with a large proportion of augit, and the colour is in most cases some tint of leaden or blueish black. With these general features this rock is sometimes remarkable for a glassy lustre arising from the flat fracture of a sort of interrupted and imbedded crystal of considerable size; the distinct particles of such fractures having a common polarity of disposition, as if each group appertained to different large and separate crystallizations. A similar appearance occurs in the augit rock of Rum, and there, although not nearly so distinct, it is evidently also produced by a crystal of augit. The rock now described displays in other cases on weathering, a structure of which the fracture gives no indication, appearing as if it had been formed of distinct globules; thus offering an interesting resemblance to the results which have been obtained from the fusion and slow cooling of trap. Such are the most common appearances of this substance, but other varieties occur, particularly in Eilan Wirrey, of which I shall only notice the most conspicuous. One of these contains minute crystals of splendent stilbite, accompanied by calcareous spar of a remarkably argentine brilliancy. It is, I believe, a very general rule, that the several varieties of zeolite occupy distinct amygdaloidal cavities in the trap rocks; but, in this case, the stilbite, as well as the calcareous spar, form constituent parts of the stone, which is of a hard and compact nature. The other remarkable variety contains mesotype as a constituent part, equally mixed throughout with the augit and felspar.

Eilan a Kily, as far as I had access to examine it, displays no beds of rocks associated with the trap: but considerable strata are to be observed in the other two islands, in both cases subjacent to the columnar masses. About the middle of the northern high face of Gariveilan a thick bed of stratified rock appears under the columns, extending to the lower neck which separates it from the peninsular projection formerly described. This bed consists of an irregular alternation of different sorts of shale with indurated clay and siliceous schist. The order of their arrangement is much too inconstant to admit of being specified to any useful purpose. The shale is sometimes fissile and soft, differing but little from that substance in its most common state of association with the coal strata. In other cases it is compacted into a thick mass, having the aspect of black chalk when broken, and not much more hard: it also contains belemnites sparingly dispersed. The indurated clay most commonly occupies the uppermost place, but that rule is not absolute. This is of a blueish or of a purplish grey colour, with a tendency to split in a direction parallel to the beds; and is so soft as to be scratched by the nail. The siliceous schist is dispersed through these beds in a very irregular manner, in small fragments and nodules, or in thin portions of discontinuous strata. It will presently be seen that it forms a more conspicuous object on the east side of the island.

The most remarkable variety of the shale is characterized by a feature very prevalent throughout these beds and abounding equally in the siliceous schist. It sometimes consists of an aggregated mass of globular grains, resembling such a substance as would result from cementing together a quantity of mustard seed; in other cases it is like a mass of damaged gunpowder in which the grains are not obliterated. These grains vary from the size now mentioned to that of a pea; but any one bed is always composed of grains of the same, or nearly equal, sizes. When fresh broken this structure is less apparent, because the intervals are filled with a looser substance of the same argillaceous nature, which when washed out by the action of the rains or the sea, leaves the exposed parts resembling, as above mentioned, a stratum of distinct or slightly aggregated spherules or grains. In a few instances the intervals are filled with a soft greenish-brown steatite, similar to that which, in Sky, is so common among the trap. I have met with no account of such a rock, but have found other instances of it among the strata of siliceous schist which occur in the trap rocks of Sky. In what respect such a disposition may have been influenced by the vicinity of the trap it is impossible to conjecture; yet, if this had been the cause, we should have expected to find the whole of the beds possessed of this character; whereas it is irregularly distributed, and is indeed perhaps most abundant in those which are at the greatest distance from the trap.

I have remarked that the siliceous schist which is dispersed among the shale at the western end, becomes more abundant towards the eastern extremity of Gariveilan. It here forms a series of three beds, which may be estimated in the thickest part at twenty or thirty feet. These are covered at the western side by the columnar trap, and when that disappears, they occupy the surface, being then incumbent on a lower mass of the same rock of an irregular form, namely, the peninsular and perforated rock mentioned at the beginning of this description. They are thus contained between two masses of trap, being slightly incurvated and elevated as if to accommodate themselves to the position of those. The uppermost is of a dove colour, having a tendency to a cubical or rhomboidal fracture, and separates naturally into masses and fragments of these and similar shapes. But when forcibly broken, its fracture is conchoidal; while at the same time it flies asunder with a violence resembling that of glass, the fragments being scarcely less sharp, and highly sonorous. The next bed consists of the same substance, but possesses a botryoidal or spherical structure similar to that of the shale before described; towards which structure a slight tendency may also be observed in the uppermost; particularly on the exposed surfaces. The third and lowest bed is a compact siliceous schist of a purplish grey hue; as hard and still more sonorous than that first described, and without any trace of the spherical structure.

Beds of shale similar to those at the west side of Gariveilan are found in Eilan Wirrey, but of much greater thickness, attaining apparently the height of 100 feet, and surmounted in the same manner by more or less regularly columnar trap. The black botryoidal beds are here both thicker and more remarkable, and the alternations as capricious as those in Gariveilan. The beds of soft clayey rock seem here also generally to lie in the immediate vicinity of the trap. Among them are seen regularly disposed and thin strata of siliceous schist, similar to those which are found independently placed in Gariveilan, and alternating with the softer beds without any regular order.

Having explained the botryoidal appearance of siliceous schist when describing Scalpa, it is unnecessary to take further notice of it here. I may only observe that it is very remarkable in some of the specimens found in this place; the surfaces of which, to the depth of an inch, are sometimes found entirely composed of spherules adhering but by small points of contact. The analogy of the other indurated strata to those which occur on the north-eastern shore of Sky must also be apparent; the pale varieties of the siliceous schist being evidently the cherty substances resulting from the induration of some of the lias beds, and the black strata being those which are produced by similar changes in the shale. It is equally evident that the stratified substances here found are in every respect analogous, both to those of Sky and to those of Egg, which occur in a similar situation under a mass of trap. They must therefore be considered as detached portions of the uppermost strata; indicating, together with those of Rasay, Sky, and Egg, a deposit, either once more connected and subsequently deranged by the intrusion of trap; or else perhaps connected, even at the present moment, by intermediate portions beneath the sea.*

There is some difficulty in explaining the variety in point of induration which is here to be observed among substances, of which the composition is apparently the same, and the position, with respect to the trap, identical. It is not however peculiar to this place, as the same differences occur under the same circumstances in Sky and elsewhere, where analogous substances are found in the vicinity of trap. Such variations have been used as an argument against the igneous origin of trap rocks; but it is scarcely necessary to remark, that among a series of effects attributed to an assumed cause, an exception does not invalidate its efficacy, unless we were in possession of all the collateral circumstances which might have influenced its action.

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* Plate XXXII. fig. 3.

A few mineral substances are to be seen in these islands, not necessarily attached to the rocks of which they are formed. Among these are considerable deposits, in the intervals of some of the columns, of that calcareous matter known to the Germans by the name of rock milk; an occurrence not very unusual among trap rocks. I observed on the beach a rolled mass of pink opalescent quartz; but this must have been brought by the waves from some distant place, as quartz of this nature is not an inmate of the rocks of the trap family.

The last and most important mineral which I found was one of considerable rarity, wavellite, hitherto discovered in but few places. It occupies rifts in the siliceous schist, but occurs very sparingly. I mentioned it long ago in the Transactions of the Geological Society, in a slight and imperfect notice, the result of a first and very hurried visit to these islands.

CANNA.*

This island presents, both in its general aspect and geological structure, characters of such frequent occurrence among the Trap isles, that, unless it be among the first to be examined, it scarcely offers any thing either to detain or interest a geologist. Its similarity to the north-western part of Sky in particular is such, that they almost seem to be portions of the same general mass.

Canna is four miles and a half in length and one in breadth; presenting on the south side an irregular declivity descending by a succession of terraced steps to the shore; while nearly the whole northern side is bounded by vertical cliffs terminating in the usual slope which accompanies the rocks of trap. Its height is estimated at 800 feet, the land being highest toward the west end, and subsiding about the middle into a flattish neck which rises again into a similar terraced hill at the eastern extremity. It is accompanied by a kind of subsidiary island called Sandy island, to be afterwards described, united to it at low water by a long reef of rocks terminating in a small sandy bay. The occurrence of sand on a basaltic shore leads the geologist at first to suspect the existence of secondary strata; but these suspicions are immediately removed on examining the quality of the sand, which is found to consist solely of pulverized shells.

The surface of Canna is almost entirely covered with fine grasses; a little heath, and that of stinted growth, being found on the tops of the hills. A few undrained flats in the same situation supply peat for the consumption of the inhabitants; but the quantity diminishes so rapidly as to threaten at no very distant time, the total annihilation of this necessary article. This island is one of the few instances now remaining in the Highlands of the system of Tacks, being held by one principal tenant, and subset to the miserable population by which it is crowded. The pasture is applied to the rearing of cattle, and the land in cultivation is so limited that the inhabitants subsist in a great degree on fish. It is one of the islands in which the growth of grain is rapidly giving way, for obvious reasons, to the cultivation of potatoes.

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* Kanin, a rabbit, Swedish; the isle of rabbits. No particular map of this island being required, the reader is referred to the general one for its position.

Its fertility depends chiefly on the quality of the soil, the result of the decomposed trap whence it is generated. But the observations already made in treating of Sky, and similar facts occurring in other places where the same rocks exist, prove, that this circumstance is not in itself sufficient to ensure the fertility of the resulting soil. In a general sense the fertile quality of trap soils has long been known, but mineralogists have not sufficiently inquired, either into the circumstances which produce this very important effect, or into the causes of the numerous exceptions which occur to the rule.

The neighbouring islands of Rum and Egg afford examples of a mixed nature, in which the grassy surface is often far overpowered by the quantity of heathy and useless covering they contain. The top of Glamich in Sky, exhibits at the elevation of nearly 3000 feet, a lawn as verdant and luxuriant as those which are found in the ornamental parks of England. But a large proportion of the surface of that island, founded on trap rocks, wears an aspect so brown and dreary as to be nearly proverbial; although their general character in those parts scarcely differs from that of the rocks of Canna. Such also is the case in Mull, while Staffa is, like Canna, covered with grass. It is probable that these varieties may arise from essential differences in the composition of the rocks, as I formerly suggested, and possibly from different proportions of calcareous earth; but there is another cause of an incidental nature to which these various degrees of fertility may perhaps with more justice be attributed. This is the state of drainage, which, in Canna is complete, from the uniform declivity of the whole island. Wherever indeed, as on the higher flat parts of the land, this effect does not take place, there the ground becomes mossy, and peat accumulates. The island may in fact be considered as in a constant state of natural irrigation much resembling the effects of the artificial process, in which the alternation of moisture and drainage is one of the most essential circumstances. In this respect, as well as in the appearance of its soil and surface, Canna bears a great resemblance to St. Kilda, where the same rocks accompanied with similar circumstances of declivity are attended by the same results.

The vicinity and relative position of Rum, ensures to Canna a rainy climate, from which, if situated alone, like Coll or Tirey, it would have been exempted; its own altitude being insufficient to affect the greater part of the clouds as they arrive from the western sea. It thus gives rise to different small streams, which, originating in those springs that occur in the rocks of this class, become more permanent than those which in the Long island are produced from ten times the extent of surface. But their courses are necessarily short, and unaccompanied by any of those deposits which in countries of greater extent so frequently attend them. The principal waste of rock is on the northern side of the island. Here, the fragments which are constantly falling from the cliffs accumulate in high slopes, increasing its superficial extent, and laying the foundation of a radical change of feature with accessions of new pasture lands.

THE rocks of Canna, however various in their aspects, all appertain to the trap family. It is fruitless to describe these varieties, and impossible to specify exactly the order of their arrangement, since it is no where constant. The description of the alternations in one portion of the island would not apply to another, and as no useful information could be conveyed by a minuteness of detail in this respect, nor any geological conclusions drawn which would not equally follow from a description more general, the reader will be satisfied with the latter.

Basalt* both columnar and amorphous, several varieties of greenstone, trap porphyry, and amygdaloids, are seen variously disposed throughout the island. The amygdaloids, like those of Sky, contain various minerals of the zeolite family, among which analcime is the most conspicuous. Considerable crystallizations of several of the forms of stilbite and of filamentous nadelstein are also to be seen, but these are more rare; while the specimens are seldom so accessible as to add to the acquisitions of a collector; those that occur being also injured by the weather or by their fall from the high cliffs.

The columnar forms are most prevalent on the southern side of the island, where many ranges may be observed rising in terraces from the shore to the uppermost level; none of them attaining a greater height than perhaps twenty feet, and some not exceeding three or four in altitude. Many of the columns are as regular in their angles and joints as the best formed of those which occur in the Western islands, while others gradually pass into amorphous basalt.

Near the ancient castle, illustrated by an engraving in Pennant's work, the singular situation of which has attracted the attention of all travellers, the approach to a columnar character is displayed in a very striking manner in the minute division and intricate positions of the prismatic concretions. To give a lively conception of its appearance it may be compared to a peat stack; the prisms resembling in shape and size, as well as in colour, the masses of this combustible after they have been dried for use.

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* Plate XIX. fig. 2.

Bituminous wood occurs in many places among these rocks, being sometimes entangled in the apparently solid trap, at others, accompanying the various substances that enter into the conglomerate. It has much of the character of oak, and is always bent or distorted; occasionally it passes into black wood coal. When first taken from its repositories it is flexible and moist, but in a few days becomes hard, and in no long time falls to pieces. In this respect it resembles many rocks which in their native situations contain water, but which lose it after a short time and are incapable afterwards of being restored to their original state.

On the shores near the low water mark, beneath the columnar rocks now described, is found a bed, or a series of beds of a trap conglomerate. This, although the lowest substance near the harbour where it is most accessible, is not geologically the lowest rock, columnar trap being found beneath it both here and very conspicuously in the neighbouring and connected island. It must therefore be considered as alternating with the other kinds of trap; but these alternations, like those of the several varieties above mentioned, are too irregular and capricious to admit of a detailed description. The nature of the beds requires however to be described. They vary in structure and general aspect, although composed almost exclusively of fragments of the several kinds of trap. In some cases they consist of an irregular mixture, more or less compact, of angular fragments, of various sizes, resembling at first view a heap of loose rubbish, while in others they are chiefly or entirely formed of that friable aggregate of earthy trap to which the name of tufo seems more peculiarly applicable. In many places they contain rounded nodules, often of very considerable size, cemented in the general mass. Rarely, fragments of red sandstone occur among the other materials; and, as in many other instances, pieces of the carbonized wood already described are sometimes met with among the other substances contained in them.

An interesting conclusion may perhaps be drawn from the presence of fragments of red sandstone in the trap conglomerate; as well as from those which are scattered on the surface of this and the neighbouring island, and have doubtless been derived from the decomposition of beds of that rock. This is, the probability that the whole of Canna as well as Sandy isle rests on a basis of red sandstone. In all cases where conglomerates occur, they are found to contain fragments of the rock on which they repose, as well as of those prior in point of date and more distant in position; the relative distances of the several original rocks being often marked by the greater or less attrition of the fragments, modified however by the durability of the substances. In this instance, as the sandstone fragments in question seem to have undergone little change, they are probably not far distant from their original beds. This view is confirmed by the structure of the neighbouring island Rum, and by that of Sky; in both of which, and particularly in the former, extensive masses of trap repose on the strata of red sandstone. Those strata have been shown to possess an even as well as an elevated position, and to be remarkably regular and persistent on the north-east line of the compass: it is barely sufficient here to recall this circumstance to the reader's attention, and to refer to the several maps on which the strata are laid down. The conclusion is so obvious as to require no further arguments, particularly as it must hereafter come under review when the whole group of the Trap islands will be compared together.

The existence of coal in this island appears also to be connected with this view of its structure, and the description was therefore reserved to this place. It is found in extremely thin laminæ accompanied by shale, and generally involved in, or covered by, the conglomerate. Similar appearances occur in Sky, but in that island, as well as in Egg, it is evident that the coal appertains to the lias strata. No indications of those strata are found in Canna, unless this may be considered as such; nor, as far as I observed, are any fragments of white sandstone or of limestone contained in the conglomerate.

I must now remark that the union of the rounded trap nodules with the substance in which they are imbedded is so slight, that they are disengaged by the sea in proportion as it gains access to them. It is plain that they owe their origin to previous rocks of trap which have been disintegrated; the fragments having been rolled in water long before they were re-united into their present situation. Of this, there is ample evidence in their structure; as, independently of their rounded form, they often consist of amygdaloids from which the imbedded crystals have been more or less completely washed away, leaving them in a cavernous state. The bed of loose pebbles thus deposited appears to have been subsequently cemented together by a fresh addition either of solid or loose matter of the same nature, on which distinct beds of columnar or amorphous trap have been superimposed. To these succeed the various irregular alternations already mentioned either of recomposed rock, or of compact trap, or of columnar basalt.

Here therefore, there is evidence of at least one epoch prior to those in which the superincumbent beds have been deposited, and involving a time considerably remote from that in which the first of these must have been formed: a period also subsequent to a preceding destruction of considerable rocks of the same substance, and consequently to a far preceding formation. But the peculiar difficulties which attend the formation of this conglomerate cannot perhaps well be understood without previously taking a general survey of the nature of the several rocks of that character with which we are acquainted. The imperfection of this sketch must be excused, from our ignorance of the different circumstances under which the various trap rocks have been formed.

Those trap conglomerates which I have had an opportunity of seeing, exhibit the following leading features. They frequently contain rolled pebbles of trap alone, while they occasionally admit granite, gneiss, quartz, and sandstone. These are united either by a cement composed of all these ingredients, or by trap sand, or by a solid trap rock of various aspects. In other cases the fragments are angular, but differ in no respect from the rolled, either in their nature or in that of the cement. These angular conglomerates possess in some instances an uncommon degree of hardness; such that the fresh fracture of the stone displays an almost uniform texture; the conglomerated structure being scarcely detected but by the unequal weathering of the surface. Of this latter variety the summit of Ben Nevis and many parts of Glenco present examples: of the more ordinary texture there are instances in the trap of Canna.

Another modification assumed by the trap conglomerates is that of a loose accumulation of large and small fragments; a rock which alone perhaps deserves the name of trap tufo, and which is so well known and so common that examples of it need not be enumerated.

It is now necessary to inquire respecting their origin, since it is plain that they are exclusively attached to this particular family of rocks, are independent of the general conglomerates which belong to the red sandstone formation, and dissimilar in other material points to all the conglomerated substances. In examining the constitution of the first variety it will be found, that independently of the rolled masses, it occasionally contains fragments of columnar basalt and of organic materials; that is, of trees bituminized and flattened as if by the pressure of a superincumbent weight; substances analogous in their chemical characters and general forms to jet and surturbrand. The imbedded pebbles will be seen to consist of the various modifications of trap which are often known to occur in the same set of rocks; of basalt, of common greenstone, of earthy trap, of unchanged amygdaloids, and of amygdaloids of which the superficial nodules at least have been washed out during their previous exposure to mechanical action. All these appear in no respect altered in structure, but resemble perfectly the same modifications as they are at present found in their original situations.

Further, if the point of contact between the cement and the pebble be examined, no change either in the one substance or the other, is found at the planes of junction. Except in some rare instances, the union between the two is slight and easily dissolved. The influence of the elements or mechanical violence readily produce this separation, since in Canna the pebbles are washed from their bed by the action of the sea.

The last appearance worthy of notice is the condition of the vegetable substances entangled in these conglomerates. I have shown on a former occasion, when treating* of the relation between the bitumens and the products of wood subjected to the action of fire, that the changes which the latter underwent from this agent were such as to convert it into a substance, which however resembling bitumen to the eye, was yet essentially and chemically different. I have also shown in the same place, that there is a connected chain of evidence and analogy to prove that vegetable matter is converted into bitumen by the action of water. I may add that the compressed forms of lignite, brown coal, and surturbrand, so changed into bitumen, display precisely the appearance of the wood found in the trap conglomerates.

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* Transactions of the Geological Society. Vol. II.

Referring to the circumstances just mentioned, there is reason for presuming that these conglomerates have all been generated by the deposition of abraded matters from water. It is difficult, perhaps impossible, to conceive that the pebbles of any of the three orders of conglomerates could have existed while in contact with a fused mass of rock; or that a union more intimate should not have taken place between the pebble and the bed at the planes of contact. It is still more difficult to believe that sand so minute and of so fusible a nature, should be agglutinated by the action of heat without being at the same time fused. It is clear that they cannot all have been formed under the circumstances from which the untransported breccias have resulted, since the rolled masses found in some of them bear the evident marks of motion. It is possible however, that those which contain only angular fragments, again cemented by the same substance, may have been thus formed. Their analogy with the corresponding class of breccias is very strong, and there is perhaps no great difficulty in admitting that if limestone, or quartz, or schist, comminuted to the state of mud, is capable during long repose and under the influence of other causes as yet concealed, of forming a solid mass of rock, some of the modifications of trap which exhibit the least of a crystalline texture, may also be formed in similar circumstances. The same cause will equally account for the consolidation of the first variety, and we shall thus be in possession of a resource for explaining, not only this particular circumstance, but some other phenomena that have been supposed to interfere with that theory which attributes the general origin of the rocks of the trap family to igneous fusion. The more perfect stratified appearances which these rocks sometimes put on, may thus be occasionally explained without having recourse to the necessity of igneous injection, which may still nevertheless have existed with the state of things here supposed.

The same conjecture also affords an easy explanation of the phenomena of organic remains imbedded in trap rocks, which, as far as I have witnessed, are always contained either in the conglomerates or in those modifications which show no decidedly crystallized texture. These appearances are however in no respect incompatible with an igneous origin, since the ejection of mud, and of matters apparently of no high temperature, is found to take place even in volcanic eruptions.

If it be admitted that the species of conglomerate now described have resulted from the causes here conjectured, there will be no difficulty in accounting for that which I have pointed out as the only one properly deserving the name of trap tuff. In this, fragments of all sizes, but generally small, appear to be consolidated by mere repose and pressure into a half formed stone, in which nothing like a general cementing substance is seen, nor any of the marks of crystallization that are characteristic of the basaltic and greenstone varieties.

Having thus attempted to show that the trap conglomerates are probably, like all other deposited rocks, formed by a consolidation of abraded trap and under water, a task of considerable difficulty remains, and that is, to suggest an explanation of the alternations visible in Canna, between these conglomerates and the solid trap rocks.

In the cases of the common transported breccias there is found one, and apparently only one formation, which may be referred to a single era; its point in time between the primary and secondary strata being well defined. One general character equally attends those rocks which are prior to it, and those which are posterior. No general formation of breccia of a later date, arising from the transportation of the more recent stratified rocks, occurs in nature.

But the case of the trap conglomerate presents an instance of a breccia formed of transported materials, of a partial nature, and limited to this one division of rocks; a division evidently posterior to some or to all of the secondary strata. This conglomerate, by whatever means indurated, is succeeded by a fresh deposit of solid trap, which is again followed by alternations of the same substances, marking a series of periods of which there are no corresponding examples in the strictly stratified and secondary rocks. The trap rocks like the granites and the porphyries are marked by many peculiarities; above all by their independence, their partial distribution, and their intrusion among the stratified substances; but in nothing more strongly than by this their exclusive appropriation of a set of conglomerates; an appearance proving in them a series of mechanical changes and a succession of eras in which the other rocks of recent origin do not seem to have participated.

It is impossible to enter much further into this subject without being bewildered in the regions of conjecture. It is apparent however, that different formations of trap occur on the surface of the earth, distinguished by difference of character as well as by differences in the relative eras of the rocks among which they have intruded. It may perhaps be reasonably argued that these are parts of one general formation, only diversified in character and situation. But the alternations found in Canna prove that the several formations visible there at least, are as distinct in time as they are in place; since lapse of time is evidently implied in the formation of a conglomerate. It also follows from the same premises, that these formations are partial; a fact perhaps generally resulting from the other circumstances which attend the rocks of the trap family; since the appearances of disturbance and renewal which characterize them are accompanied by no corresponding changes in the later stratified rocks. It appears equally to follow, that the deposits of trap have a tendency to recur in the same spot; as in this, among many others, there is found a succession of partial formations limited to a narrow space. If it be argued that the trap has formed one universal bed over the surface, which subsequent changes have partially destroyed, a more accurate correspondence should be exhibited between the neighbouring rocks of this class; in the case for example now under review, between those of Canna, Rum, Egg, and Sky.

I am aware that the opinions thus hazarded on the partial formations of trap and on their repetition in the same spot, may be supposed to give a colour to the well known hypothesis of their recent volcanic origin. But the other evidence of this is too deficient to afford any just grounds of conclusion; while it is scarcely necessary to say that ancient volcanoes, sometimes evidently submarine, are capable of fulfilling all the requisite conditions. Should these appearances be even supposed the consequences of ordinary, but distant volcanic eruptions, they are not difficult of explanation. Posterior changes of the earth's surface, of which the traces are so generally diffused, might easily have divested these mountains of the peculiar substances that characterize existing volcanoes, since these are frequently of a nature to suffer from such revolutions; while the peculiarity of form which the places now in question exhibit, may equally have resulted from changes of such a nature as to leave little or no traces of their original outline. Amid the alterations that appear to have taken place on the surface, it is asking for very little to suppose that these partial deposits of trap are the remains of more extensive masses.

The similarity between the trap rocks and those of volcanic origin has been too often noticed to require a repetition of that remark. It is equally known to geologists that volcanoes are situated in this class of rocks; a position which appears to countenance the opinion that there is a connexion in the origin of the two; and that the recurrence of trap in any given place, such as it is observed in the island under review, is a phenomenon closely linked with the actual existence of volcanoes in districts of trap rock.

It is still necessary to point out a circumstance of no uncommon occurrence in the trap of this island, as well indeed as in many others which I have examined; partly because it confirms this conjecture and is an additional proof of the resemblance between the traps and the lavas, and partly because it has been doubted or denied by many geologists who have treated of these rocks. This is the existence of cavities resembling in every respect those which are contained in the scoria of volcanoes, or in cellular lavas. They occur also abundantly in Mull and in the trap near Oban; and are particularly conspicuous in some parts of the little Cumbray, where I shall have occasion to describe them more fully.

The results which follow from the existence of such cavities are evident, since they remove the necessity of supposing that the trap rocks, admitting them to be of igneous origin, have been formed by submarine eruptions and under great pressure. The distinction must cease with the loss of the proofs on which this supposition is conceived to rest; and these rocks might therefore be assigned, as far at least as any proofs to the contrary have yet been produced, to causes of the same nature with those which now operate in producing lavas; to ancient volcanoes, of which the other and perhaps more characteristic traces have disappeared among many other records of the former state of the globe.*

Canna has long been celebrated for the disturbance which its rocks produce in the magnetic needle; but this circumstance is equally remarkable in most of the basaltic countries which I have examined,[*] nor is it here peculiar to the Compass hill, since it also occurs in many other parts of the island. This influence is occasionally limited to a space of three or four feet, but is also sometimes extended to distances much more considerable so as to produce a decided effect on the variation of the needle. There is no doubt that it has, where unobserved, been a frequent cause of error in maritime surveying as well as in surveying on shore where the compass is used for the observations, or when the position of the theolodite is regulated by the needle. But as I have entered into this question at some length in a paper on Glen Tilt published in the Geological Society's Transactions, I shall refer to it for a fuller account of this subject.[†]

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* Having expressed some doubts on the propriety of the use of the term *trap tuff* as applied indiscriminately to all these breccias, a few remarks on the use of this term will not be esteemed improper. The original term, tufo, is applied by the Italians to loose or stony aggregates of volcanic sand or volcanic fragments. From this original sense it has been so far extended as to include at present the following discordant substances: calcareous incrustations and deposits, certain loose sandstones found connected with trap rocks, decomposed basalt or greenstone, basaltic angular breccia, and basaltic conglomerate bearing the marks of mechanical attrition. There is no greater enemy to sound reasoning than a lax use of terms; and it is no small metaphysical evil that laxity of nomenclature is too apt to lead to laxity of thinking, and to produce consequent careless habits of observation and reasoning. Moral science bears evidence perhaps even more striking than physical, of the evils arising from the abuse of terms alone; although the history of the latter for a period of many centuries is not deficient in this respect. The science of geology owes no small share of the rapid progress it has lately made, to a more precise language; and it is desirable that such precision should still be extended where it may appear wanting. If the term tufo be considered as generic, it is evidently inapplicable to substances so discordant as those above enumerated, nor is there any reason why a conglomerate rock formed of granite or schist should be designated by a term different from one formed of basalt, since similar causes have conduced to the formation of both. The generic distinction is in the one case derived from the mechanical disposition and not from the mineralogical character, and it is equally and properly applicable to both. The specific distinction of those conglomerates which consist of trap rocks, may be readily made by specifying the component parts. If the name of trap tuff is to be retained it should be limited to those accumulations of matter resembling real volcanic tufo which are well known as occurring in the trap rocks. By this method both uniformity and accuracy will be introduced into the language of geology, as far as respects these substances.

I SHALL subjoin to the description of Canna some remarks on a circumstance which, although not peculiar to this island, is presented with great distinctness on various parts of the coast. It relates to the disintegration and consequent destruction of the rocks, and will be found to add a material fact to those already known respecting this process; so interesting in a chemical view, and so important in its results, from the extensive changes which the surface of the earth undergoes, both from its accumulated effects and from their remoter consequences.

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[*] It is very remarkable on the summit of Glamich in Sky.

[†] Independently of the local disturbances produced in the Western islands by the proximity of the masses of trap, there is a general irregularity of the magnetic variation prevalent throughout the Western coast; produced, doubtless, by the combined influence of the larger tracts, whether of this or of other rocks. It is sufficiently sensible at sea to diminish materially the use of the compass in navigating these islands; fortunately that instrument is not often wanted, as it rarely happens that some land cannot be seen. At the period of one of my visits, the general variation was stated at about 26° west. From observations then made, I found it 19° in Loch Ryan and 30° on the east shore of Sky, while in many other places it presented similar irregularities. These were confirmed by Capt. Ross in the Driver sloop of war, who found it to be 21° near the Craig of Ailsa. My own trials were independent of the ship's attraction, as they were made on shore; the needle being elevated as high as possible above the surface.

The appearance in question is most conspicuous in the breccia that occupies the lowest situation on some parts of the shore; but is not limited to that rock, since it also occurs in the prismatic trap and in the amygdaloid.* The waste of these rocks from the action of the atmosphere is considerable, and the indications of it are visible in many other cases besides those of the detached masses so remarkable on the shore of Sandy Isle and on the eastern side of Canna. But where the high water mark commences, the indications of which on rocky shores are almost always sufficiently marked by the Lepas Balanus, there is a sudden stop to the wasting process, which, although it may vary in the different kinds of trap, is generally visible every where. In consequence of this, a kind of platform is seen at low water, skirting the bases of the cliffs; often reaching to a great extent, and thus indicating the different degrees of rapidity with which those parts of the rock exposed to the air only, and those subjected to the vicissitudes of sea and air together, have undergone decomposition. In some instances, where detached turriform or pinnacled rocks are seen, the appearance is peculiarly remarkable, since they seem as if they had been erected on solid platforms, the flat surfaces of which denote the level of the sea at high water. Contemplating the rapid waste of these rocks, it is easy to look forward to a time when the pinnacle shall disappear, and no trace of it remain but the half sunk rock, breaking at high water and denoting its former place.

There can be no question respecting the nature and existence of this appearance, since it occurs in other places besides Canna; but as yet I have had no opportunity of extending the observations so far as to decide to what kinds of rock it belongs or to which it may possibly be limited. I may however enumerate those places where it is to be seen.

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* Plate XIX. fig. 4.

It is very conspicuous in the island of Staffa, where the excess of waste in the parts exposed to the atmosphere only, above that where the action of sea and air alternate, is strongly marked by the columnar causeway which in many places extends so far beyond the vertical face of the island.

I have pointed out a similar appearance in Rum, in the platform which extends from Harris to the point of Bridianoch; and it is also to be seen, although in a less marked manner, on the southern shores of Egg, as well as in many parts of Mull and Sky which it is unnecessary to enumerate. In all the cases here quoted, the rocks are of trap or syenite, but the circumstance is by no means limited to these.

A long range of secondary rocks has been described as extending from Portree to the northern end of Sky, and the same has been shown to exist on the eastern side of Rasay. In both these instances, the strata being nearly horizontal, and the cliffs decomposing so as to present mural faces, the effect is equally remarkable as in Canna or Rum where a similar mode of wasting prevails. The strata, whether of sandstone, shale, or limestone, are here found projecting far beyond the cliffs in the form of flat shores, never rising above the high water mark; while the surface of the uppermost stratum, whatever that may chance to be, appears to resist all efforts towards waste; at least for a comparatively long time. A similar durability under the same circumstances is found in the gryphite limestone of Sky and of the adjacent islands; although the effect is less conspicuous in consequence of the inferior altitude of the land. The result in these cases is seen in the long extended reefs and foul shores which render this coast so dangerous to vessels engaging too near with the land. I may add that the same circumstance takes place in the island of Muck and in the Isle of Man. In these latter examples limestone is the prevailing substance; but it is worthy of notice that even the very soft shale found in Pabba and on the Broadford shore, seems to lose its decomposing property as soon as it has wasted to that level where it becomes exposed to the diurnal action of the sea water.

It may be perceived by the instances thus adduced, that the most conspicuous examples are found in the trap rocks and in the secondary strata, but the effect does not appear limited to these alone. To the same cause are doubtless owing the projecting rocks which are almost invariably found to skirt rocky shores of whatever substance these may be composed; the further ruin of the cliffs appearing to meet with a check wherever the sea comes into contact with them. The difference in the apparent effects in the case of these rocks, seems partly to arise from the different mode in which they are disposed, in consequence of which the waste cannot take place in angles so nearly vertical, nor the effect arising from contrast be so strongly perceived; and partly, it is to be presumed, from their greater durability and more tedious destruction.

It is perhaps not difficult to assign the causes of this phenomenon. The ordinary causes of decomposition are too well known to require enumeration: and one of these appears equally to act in both cases; namely, the change produced in the iron of the compounds by the access of air and water. But from the other and next most obvious cause of decomposition, namely, the action of frost, it is evident that the rocks are in one situation excluded, while they are exposed to it in the other. To this we are perhaps to assign the whole difference above mentioned; and we are thus led in these colder regions, to ascribe a much greater power in changing the face of the earth to this agent, than to any chemical actions; the operations of these appearing to be confined within limits comparatively narrow. It is evident that similar observations, made in countries where frost is unknown, would be required to confirm this view; but the subject not having heretofore engaged the attention of any one, I am unable to adduce any remarks bearing on the question. If the fact be really such, there will result a great difference in the durability of mountains as well as of sea shores in different parts of the earth; but it is unnecessary to enter deeper into this speculation.

At the same time I cannot conclude the subject without remarking that this protecting power of the sea is a fact of considerable importance in marine architecture, and may lead to valuable precautions in cases where the architect has a choice on what foundation his light house or his pier shall be erected. It may perhaps induce him, in cases where he has such a choice, to prefer a submarine basis; particularly when the rock intended for the building has from its nature a tendency to exfoliate or decompose. Had the foundations of the castle and of the walls of Conway been washed by the sea, so many parts of these structures would not now be suspended in the air and relying on the tenacity of the work. It is satisfactory also to know that the rotten state of the gneiss on which the Eddystone lighthouse is built, presents no cause for fear respecting the permanence of its foundation.

SANDY ISLE.*

THE preceding remarks on Canna, are for the most part so applicable to this island that little need be said respecting its structure. It may almost indeed be viewed as constituting a portion of the former, the two being united at low water by the beach of shell sand already mentioned, and by their union forming the most frequented harbour on this coast. The bustle and life which it presents, when crowded with merchant vessels detained by adverse winds or foul weather, form a striking contrast to the solitude of those scenes where the geologist is often compelled to cast his anchor; either in pursuit of his peculiar objects, or as a refuge from the elements which the want of sea room will not allow him to brave. Perhaps he may not think it the least of the merits of this port that he can here renew his sea stores; not easily replaced in a voyage which is calculated to impress on his mind the numerous, though often unacknowledged conveniences, for which he is indebted to the habits of improved life; and of which he has perhaps never before been thoroughly sensible.

That side of the island which lies next to Canna is low, while towards Rum the land rises into gentle elevations terminating in abrupt cliffs and skirted with detached masses of rock of considerable height.

The rocks called Dun na Feulan (the gull rocks) afford almost the only picturesque scenery which these connected islands possess. There are two of different magnitudes but of the same height, situated at a short distance from the cliffs. Their altitude does not appear to exceed 100 feet, but they form some striking combinations with the surrounding cliffs. The smallest is thin in proportion to its height and of a steeple-like form, while the other resembles a huge tower. They are seen to great advantage in gales of wind, when the high mountains of Rum are involved in clouds and the tide of this rapid strait is breaking on the shores; circumstances indeed always peculiarly appropriate to the wild features of these rocky coasts.*

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* See the general Map.

The general alternations of the trap with the conglomerate are more visible in Sandy isle than in Canna; and it is much more easy to trace the beds of coal and shale. But there is one peculiar circumstance here in the disposition of the conglomerate, which is worthy of remark: it occurs in the steeple-formed rock above mentioned. That substance is here divided from the solid trap by a vertical, instead of a horizontal line; the one side of the mass being constituted of the former, and the other of the latter. In other respects the substances and their connexions are precisely the same as in Canna, or in the other parts of this island where they lie in a horizontal position.† It is not easy to explain this appearance; but it is not impossible that the whole mass has been thrown down from a superior position, into that in which it now stands; as there are no symptoms of a similar general disturbance in the island itself, and it is not conceivable that the conglomerate should have been deposited in its present position in one limited spot only.

Sandy isle, like Canna, presents examples of a circumstance rare in the Western islands; namely, loose fragments of a different rock from that of which it is formed, lying on the surface. These are large blocks of red sandstone, somewhat rounded; and they are found in considerable abundance on the flat shores of both. They are not to be seen in the higher parts of these islands; nor are there any strata or remains of strata now existing,

* Plate XIX. fig. 2.

† Plate XIX. fig. 3.

from which they could have derived their origin; while they are far too large to have been accidentally transported as ballast, or brought intentionally for building. The rock of which they consist is that which forms so large a portion of Rum, and of Sky. They may possibly have been transported from the former of these islands before those changes of the surface had taken place of which there are not wanting abundant indications over the whole globe. It is however more probable that they have been derived from portions of the conglomerate rocks formerly described, at a period when these occupied a greater space than they do at present; the most durable substances remaining thus insulated, while the cementing trap has mouldered into soil.

WHILE detained by gales of wind in the harbour of Canna I had an opportunity of observing the characteristic veneration which the Highlanders possess for medicine; proportioned, as it would seem, to the scarcity of its professors. It would be unpardonable not to bestow a cursory notice on the diseases of the Highlands; since they form a frequent object of inquiry among those who have comparatively few opportunities of being informed respecting them.

Fever rarely now visits this country, although, by all concurrent testimony, once prevalent and fatal. The change cannot be attributed to superior cleanliness or comfort; as in these respects the houses have undergone no change, and the inhabitants but little: it doubtless originates in the more ample supply of food; the contagion appearing, in all the recorded instances, to have been generated after seasons of scarcity; a cause of fever well known to physicians. But I must remark that it has within a few years found its way with renewed severity into some of the most improved districts on the borders of the Lowlands; the consequence, it is to be feared, of partial and improvident ameliorations in the accommodation of the lower classes. Under the ordinary construction of the cottages there is no chimney, as the fire occupies the centre of the building; so that the smoke and heated air must fill every cranny before they can escape; while a perpetual ventilation being kept up from doors and windows which cannot be closed, it is difficult for contagion to be accumulated. The partiality of the Highlanders to this rude mode of warming their houses, proceeds from its economical and effectual nature; its utility in preventing the generation of disease being too refined for their observation, although there can be little doubt of its efficacy in this respect. In the improving parts of the country, the proprietors, very laudably studious of the comfort of their tenants, have introduced fireplaces with chimneys; either by building themselves, or by limiting their tenants in their leases to that construction. Thus the effectual circulation of heat and air is counteracted, and the penetralia of a Highland hut, doomed never to meet the light of day, are suffered to accumulate the effluvia of generations. The chimney is premature; and till general habits of cleanliness are introduced, the result here pointed out must occasionally follow; while the contagion once generated becomes permanent; being recalled into action during successive favourable seasons.

Bleeding is the universal remedy in this disorder, and I may add that the practice is successful. On no occasion have I witnessed any remarkable popular remedies or superstitious practices. These, with other peculiarities, are fast wearing away.

Among the most fatal diseases in this country, are acute pulmonary inflammations. Bleeding is here also performed by the natives, but in so insufficient a manner as not to check the progress of violent cases, of which the fatal terminations are but too frequent, however occasionally protracted. Consumption is by no means prevalent, although instances of it occur in cases where the scrofulous habits, not very uncommon in this country, have been called into action. The diseases consequent on scrofula take place here in the dark temperament equally as in the sanguine; doubtless in consequence of the insufficient food of the labouring community; a circumstance always ready to excite its dormant energies where they might not otherwise appear.

It might be expected that chronic rheumatism would be common in a climate so moist, and among a people to whom rain seems a matter of indifference; since they will not often seek shelter from it, even when in their power. This however is not the case, nor have I observed that rheumatism in its other modifications is more prevalent than in the low country.

Intermittents are not known; nor are the autumnal diseases in general to be found where the season itself cannot be said to exist.

I know not that there is any thing worthy of notice respecting the eruptive epidemics. Disorders of this class are not readily propagated far among a scattered population: but for the honour of the country I must remark, that vaccination is almost every where anxiously sought after, notwithstanding the imputed fatalism of the Scottish presbyterians.

The sibbens is unfortunately too well known as an endemic in the Highlands, but like other contagions which require intimate contact for their propagation, it is still limited to particular districts. Among the islands it scarcely occurs, except in Isla, where least of all it would be expected; since the inhabitants of that island have advanced considerably beyond their neighbours in improvement. With respect to cutaneous affections it may safely be said that the supposed opprobrium of the country has vanished.

The extreme prevalence of dyspepsia is perhaps the most characteristic circumstance in the whole catalogue of Highland ailments. This is so common, that among the female sex it is rare to meet one of a certain age free from it; among the men it is not so prevalent. It is attended with all its usual train of Protean symptoms; and often, to a degree of violence which will surprise even the physician long versant in the formidable catalogue with which, in the course of more fashionable practice, he is hourly persecuted. The mental affections which so commonly accompany it are also here exhibited in perfection; in all their modifications of hypochondriasm, and with the caprices and hallucinations which have been falsely supposed to arise from indulgence and indolence. He who is accustomed to administer to the diseased minds of the rich and the luxurious, believes that he would often find a remedy in abstinence, in occupation, and in exercise; provided he could prevail on his refractory patients to abandon their usual gratifications, the supposed causes of this disease. Here, he will find all these supposed remedies in compulsory use, and the disorder equally obstinate and equally defying his powers of cure. Philosophers are often accused of generalizing prematurely; and certainly in assigning the causes of this malady physicians have not been deficient in that respect. If labour, occupation, and a moderate diet, could remove or prevent this disease, it would not be found here; if real care could prevent the attack of that more formidable invader of human happiness, imaginary care, the diseases of the imagination would not exist in the Highlands. Whether the cause may not consist in the reverse, the want of sufficient food, is a question which will probably be answered in the affirmative. How far this prevalence of the hypochondriacal affection may conduce to certain mental phenomena for which the Highlanders have been remarked, is a question of some interest. It is in such minds at least that the hallucinations of second sight and other supernatural appearances might be expected to predominate.

I have hinted at the deficiency of food among the Highlanders. The introduction of the potatoe has done so much to remove this once prevalent cause of misery and depopulation, that such a want is scarcely suspected. It is however still apparent. At present, it is true, the Highlander rears a fair proportion of children, the average number varying between three and four; a great proof of amelioration in the means of living. The children are also universally strong, ruddy, and handsome, yielding nothing in that respect to their better clothed and better lodged neighbours of the low country, or of England. This air of health and good feeding continues till the age of labour, and for some space beyond it. But at twenty, or shortly after, an evident change takes place. The skin shrivels, the bones of the face project, and the marks of age, already perceptible, increase rapidly to that period in which it becomes sensible in the labouring part of the community every where. After that, there is perhaps no further comparative difference, and the limit of the Highland labourer's life stands on a fair average with that of the Lowlander or Englishman. This change is most sensible in the women. Instances of beauty are by no means uncommon in female children. But it vanishes at seventeen, and shortly after, the marks of age hasten on so rapidly that, (with deference to the Highland fair it must be said,) they acquire that aspect so dreaded by Queen Elizabeth, or the ancient fair one recorded in the well known epigram of Plato. This effect seems to proceed from the insufficiency of the food compared to the labour; and to those who have seen the country I need scarcely say, that an equal, if not a greater share of that labour, is often the lot of the females. There is reason to suspect, from the greater durability of the lower classes of the Irish, where potatoes form the sole food, that this root is superior in its nutritive qualities to oats or barley; and we may therefore slight the misplaced compassion of those who lament the hard fate of the

Highlander in the islands where a sufficient supply of oatmeal cannot be procured, and where the inhabitants depend on the potatoe. If the rapid increase of population, abundantly obvious throughout the country, had not in itself a necessary tendency to increase the production of this root and diminish that of grain, it is likely that the experience of the people themselves will gradually, however slowly, produce the same effect.*

It has been often said that examples of longevity were common in the Highlands, and the tale has been repeated till it has almost become an axiom dangerous to doubt. A well known and remarkable instance is often quoted from Pennant, but it is probably a solitary one; since other inquirers have not found similar cases, and no satisfactory evidence has been produced to justify the general assertion. The tourist who hurries through the country may perhaps adopt this notion, from the numbers of old people whom he sees in the cottages, or engaged in some sort of labour when nearly past the power of labouring. But it must be recollected that the aged and infirm continue to reside with their children when no longer able to maintain themselves; and that there is no asylum, like the workhouse or hospital of England, where these objects are concealed from the public view, and almost lost to the public recollection. Hence the aged are seen every where; and hence the easy but superficial conclusion, that they are in greater proportion here than in England.

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* It must be remembered however that there is a countervailing evil in the use of the potatoe, which, however distant, is of a most important nature. It is indeed obvious that the potatoe system, as it is called, is making a rapid progress in many districts; and it is to be feared that in no long time the consequences that have followed it in Ireland will also find their way into this country.

RUM.*

Although the rough and dangerous shores, the trackless surface, and the perennial rain of this island, are repulsive to the general traveller, the geologist will here meet with appearances of such interest, as to induce him to brave its tempests and to defy the toil which he must encounter in its investigation. So rude and barren is Rum as to be of less value in proportion to its extent than almost any one of the islands described in this work. Even kelp, that staple commodity of the Western islands in general, is nearly denied to this, its steep and weather-beaten shores refusing a hold to the marine vegetables which abound throughout this sea.

The general aspect of Rum is mountainous, and it may be said to consist of an irregular group of high hills rising out of the sea; without plains, and scarcely diversified by an intervening valley. This group may, in a general point of view, be considered as divided into two parts, the highest occupying the eastern extremity of the island, and that next in altitude the western. But the division is not strongly marked, since it consists only of a lower class of mountains; and I may add that the northern side of the island presents a still lower range descending towards the shore with a more gentle declivity. I had an opportunity of observing by the barometer the height of Oreval, the most elevated of the western summits, and found it to be 1798 feet. Storms and clouds prevented me from repeating the observation on Ben More, the highest of the eastern group; but it may be estimated at 500 feet more, while the two remarkable sharp pointed summits of Halival and Haiskeval seem, from various points of view, to possess nearly the same elevations.*

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* Rum, Danish, wide, ample, roomy. A more probable etymology than Dean Monroe's Ronin.—See the Map.

The eastern group, including Halival, Haiskeval, and Ben More, is almost perpetually involved in mist. If the clouds descend on the Cuchullin hills of Sky, it rarely happens that those of Rum, although so much inferior in height, are free. To this is owing the great proportion of rain which falls in the island, and hence also arises in a great measure the moory and unprofitable state of so large a portion of its surface. This property of arresting the clouds on their arrival from the western ocean, depends partly on the absolute height of the mountains, but still more on their insulated position; as they form the only high land that lies between Sky and the mountains of Mull; both equally noted for the torrents of rain which they precipitate on the surrounding country. It is here that I have frequently observed a meteorological phenomenon, which is also common in St. Kilda; namely, that appearance in the clouds which is termed parasitical. The general causes of this phenomenon have been often discussed by philosophers; but having on one occasion observed it to be attended with particular circumstances, it will not be superfluous to describe the appearances then witnessed.

Those who have travelled in mountainous countries must have often remarked that, even in a strong wind, a cap of mist will frequently involve the summit of a single hill: appearing to be in a state of absolute rest, while the neighbouring clouds are sweeping rapidly along under the influence of the gale. This appearance has sometimes been attributed, either to the existence of partial currents of air, or to some peculiar electrical condition of the hill, which gave it the power of retaining a covering of vapour within the sphere of its influence. On the occasion to which I allude the true nature of this very common phenomenon was apparent; while a beautiful example of the formation of clouds in a transparent atmosphere was at the same time presented; attended with other circumstances less easy of explanation.

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* As there is no other map of the island than the sea chart, I have been obliged to give such a sketch of the ground as could be made by the eye, without which the places and relations of the rocks that form it would be unintelligible.

The wind was north-east, and the breeze, which had blown moderately all the day, began to freshen considerably as the sun went down. Not a cloud was to be seen in the whole hemisphere while the sun was above the horizon. The island of Rum was about three miles to the westward, and its two most remarkable summits Halival and Haiskeval were visible, the vessel being in such a position beating to windward as to preserve a parallel with the current of wind and the land. Shortly, a cloud appeared hovering over one of the mountains, and maintaining a constant distance at an elevation of 200 or 300 feet above it; never approaching or receding from it materially, while a similar cloud involved the other, resting on and surrounding its sides at a considerable distance below the summit. The freshness of the breeze seeming to be at variance with this appearance, I was induced to watch it more narrowly. The detached cloud was perpetually undergoing various and rapid changes; altering its form, magnitude, and density, in a most capricious manner, but still maintaining its distance from the top of the hill. After observing it for an hour, it was perceptible that it was receiving a constant increase at one end, and undergoing a constant corresponding diminution at the other; its average size remaining the same. On the side from which the wind came, a thin faint vapour began to form at a certain distance from the mountain. This gradually increased in size and density as it drew nearer, and having arrived at a point over the top of the mountain it appeared to have acquired its maximum, forming a thick black cloud. In a minute or less it retired in the direction of the current of air, diminishing in density as it receded from the mountain; and having reached a distance equal to that at which it first began to form, it suddenly dissolved and disappeared, its place being uninterruptedly supplied by a fresh formation.

The cloud which rested beneath the summit of the other mountain, seemed for a considerable time in a state of absolute tranquillity, undergoing no sudden changes of shape, but forming a dark stratum. It was soon however obvious that this also was in a similar state of constant renovation and waste, although its changes of figure were much less apparent; and that this mountain, like its neighbour, was causing a perpetual precipitation of fresh vapour from the atmosphere as far as its influence extended; that vapour being again dissolved in the air as the current drove it from the sphere of the mountain's action.

It is plain that if the solution of the vapour in the atmosphere had not kept pace with its precipitation by these two mountains, the whole visible sky would soon have been covered with clouds; so small a surface of land in a particular condition having the power of producing such a constant and large precipitation of vapour. It would not have required an hour to have involved the whole surrounding country in clouds and darkness. That this effect did not take place was probably owing to the direction of the wind, which blew from the land to the sea. Had it blown in the opposite direction, it is probable that the constant action of fresh portions of land would have continued the effect at first produced. It is unnecessary to point out the coincidence of this phenomenon with the well known power of land in generating clouds from those currents of air which blow from sea; nor with the equally well known property of high mountains in determining the formation of clouds and the fall of rain on certain tracts of country. In this particular case no fall of rain took place in Rum, from the absence of some unknown condition in the land or in the vapour; but it is plain that with some modifications of that condition, this island might have been deluged in rain, (as it often is) while its more humble neighbours were enjoying a cloudless sky.

There is so much difficulty in explaining the general causes of these appearances, and the theory of clouds and rain is as yet so imperfect, that there is no reason to be surprised if we are unable to account for the different effects which these two mountains, whose summits are not perhaps half a mile asunder, produced on the same atmospheric current. It has appeared that the one exercised, together with its precipitating power, a constant repulsion, maintaining the condensed vapour at an invariable distance; while the other, although in its immediate vicinity, combined together with that power, the property of attracting the vapour into close contact. In attributing these discordant actions to electrical influence, it is probable that the true cause is assigned; although we must at the same time equally confess our imperfect knowledge of the mode in which that cause operates in producing these effects, as in the production of those numerous and important meteorological phenomena which also appear to depend on it. It may perhaps be suggested that the precipitation was merely the effect of a difference of temperature between the land and the atmosphere; and that the different action of the two mountains in attracting and repelling, arose from their different electrical conditions; conditions which we are acquainted with in the electricities of approximate bodies as they occur in our confined experiments.

Under such a climate, and with a soil of almost the worst qualities, it is not surprising that there is but little cultivation in Rum. Even that little is too much, as far at least as relates to white crops; to the culture of which the stormy nature and asperity of the climate are peculiarly inimical; no less than the almost incessant rains are to their harvesting. To say that the badness of this system is the effect of excessive population, may appear surprising, when it is stated that the number of inhabitants does not exceed 350 in an island of dimensions so considerable. But being almost utterly unfitted for cultivation and incapable of improvement, it is truly encumbered with population; a cause of suffering to the proprietor as well as to the tenants themselves; the former of whom might raise a greater rent together with a greater produce from an extensive system of sheep farming; while the comforts of the tenants could not fail to be improved by their partial removal from a soil inadequate to their maintenance under the present and only system of agriculture which so divided and poor a tenantry is capable of pursuing.

In consequence of its rainy climate and the favourable nature of its rocks to the formation of springs, this island gives rise to some perennial streams; which, for a country of so small an extent, are of considerable magnitude. The two largest of these are at Harris, where they almost meet from the opposite hills; raging at times with great fury, like the torrents of higher lands, and marking their violence by an enormous accumulation of stones which forms a great terrace near that village. This is the only alluvial matter of any note in the island; the remaining rolled fragments consisting merely of such substances as are annually detached from the mountains by the slow but effectual operations of the weather.

From Loch Scresort to Giurdil on the north side the shores are skirted by low rocks or cliffs of moderate elevation, with two or three small beaches interposed, the whole of this line being formed of sandstone. The remainder of the coast, with similar exceptions, consists of high cliffs, attaining in some places to an apparent elevation of 400 feet, and formed of various rocks which will be described in their places. On these shores the western swell scarcely ever ceases to beat, so that it is rarely possible to land for the purpose of examining them; while they are at the same time inaccessible from above. The geologist who wishes to make himself intimately acquainted with this coast, even where it is more accessible, as well as with many others throughout these boisterous seas, must learn to despise the winds and the waves.

THE rocks of this island present examples both of the stratified and unstratified classes; and although I hope to make their relations apparent, it is very difficult, even with the assistance of the accompanying map, to mark the regions which they respectively occupy. All the care bestowed on the investigation is too often rendered unavailing for that purpose by the incorrectness of the maps and charts of these islands, by the total want of villages or other points of reference, and by the difficulty of obtaining the native names of the hills, rivers, and promontories, which, in the absence of better marks, might be made to serve this purpose. The reader must be content to receive his information in the best form in which I am able to place it.

The observations already made in Sky have so far determined the order of arrangement of the stratified rocks found there, as to serve for a basis in the description of those appertaining to Rum, which resemble them so much in every essential circumstance as to leave no doubt of their being both portions of one common deposit.

It was shown that the red sandstone of Sky formed, together with different beds of schist and quartz rock, a great body of strata lying in a north-easterly direction and dipping towards the south-west. The general resemblance of the sandstone which constitutes a very large portion of Rum to this, made it important to ascertain whether they were parts of the same mass; a circumstance to be determined, partly by the bearing and dip of the strata, and partly by the identity of the rocks preceding or following them. As the disturbance of the magnetic needle is in this island considerable, I cannot be assured that the bearings of the strata are very precisely continuous with those of the sandstone of Sky. Yet they appeared such in those places where they presented the most continuous extent, and where they were at the greatest distance from the trap rocks. I have accordingly, in the subjoined map, laid them down as north-easterly throughout the island; a rule which will be found to hold good to the north of Loch Scresort, and to require modification only in those places where they display a less extent, and are immediately in contact with the masses of trap that form the mountains. It is superfluous to state the probable cause of these exceptions, the subject having so often already fallen under notice in different places. Under similar exceptions the dip of the strata is also to the westward; the angles of elevation being generally considerable, but varying in different places as they do in Sky. Whether the strata are precisely rectilinear or not with those of Sky, there can be little doubt of their general identity of position; nor any reason to hesitate in considering both of them as portions of one deposit separated by the intervening sea. Thus, as I have already pointed out, the same rocks will be found reaching with little, if any, disturbance of position, from Rum through Sky and Scalpa to the Croulin islands and to the mainland: a connexion which is indicated in the general Map.

I had not the good fortune to observe in Rum any of those secondary strata which in Sky are superimposed on the red sandstone; although I searched for them among the uppermost beds in those parts of the island where they might be expected. It is probable that they do not exist, since the avidity with which calcareous rocks are sought for by the farmers throughout the islands, would necessarily have led to the discovery, either of the gryphite limestone which in Sky follows the sandstone, or of the lias beds which, as will shortly be seen, occur in the neighbouring island of Egg. Nor is there in Rum any indication of the gneiss or of the chlorite schist which in Sky precedes the sandstone; this rock being the only regular stratified substance in the island. The proof of the identity of these strata in the two islands must therefore rest on the community of position and of structure which characterize them in both.

The beds of schist* appertaining to this series are in general situated very low on the shores where they occur, and may be seen in different places, lying immediately below the red sandstone. They consist of an irregular alternating series of dark blue clay slate with blue quartz rock, precisely similar to those of Loch Eishort in Sky; like them conformable to the sandstone above, and occasionally alternating with it. They are first visible at Cove, and in proceeding to the south, they continue to rise till they form cliffs of considerable altitude; when, their inclination gradually changing, they become at length horizontal. The cliffs vary in height, and beyond Glen Debble attain an elevation of about 100 feet. In general these strata are very even and regular, although they are in many places traversed by trap veins; but in some instances they seem to be disturbed. Beyond Glen Debble, at a nameless point, they change their inclination, and thus, subsiding below the sea, are lost to the sight. It is here unnecessary to make any further remarks, either on this series of rocks, or on the connexion of these strata with the superincumbent sandstone; as these points have been sufficiently examined in describing the preceding islands. The circumstances already mentioned are sufficient to prove their identity with those formerly reviewed.

It is equally unnecessary to enter into details respecting the nature of the red sandstone, since it has also been described in the same places. But tracing its progress through Rum, it may be seen from the point already mentioned, following in a regular series of beds to Loch Scresort. It constitutes the shores of this bay, and may also be traced high up into the country on the sides of Halival, as well as into a lower class of hills which rises to the south and west of Loch Scresort. The highest point at which it was observed was estimated at 1200 feet. On the shores of Loch Scresort the beds are perfectly even and parallel, with an uniform inclination. This character is maintained for a considerable space through the hills; but at length they become waved, broken, and disturbed in various ways, displaying in some places violent contortions; all these irregularities occurring in the neighbourhood of the great masses of trap. The veins of the same substance which are common throughout them, seldom or never produce any marked disturbance. Towards the north, Loch Scresort is bounded by a high hill, which extends along that shore as far as Camispleasig, and displays the regularity and inclination of the sandstone beds to great advantage. They incline, as already said, towards the north-west, the angle of elevation varying between twenty and thirty degrees. The southern declivity of this hill consists of the protruding ends of the strata, which follow each other like stairs to the summit; the declivity at the opposite side being formed by the inclined surfaces of the uppermost beds. From a rude estimate of the number of these strata compared with the apparent dimensions of each, the thickness of the mass may be estimated at 600 feet. This is however but a portion of the whole deposit, since there are many beds in a lower position between this point and the schistose strata already described. It is also probable, that of the beds which follow on the north shore toward the west, many belong to still higher parts of the deposit; and that its thickness is consequently far greater than can readily be discovered by following the most accessible of the strata in the order of their superposition. In treating of Sky, the great thickness of the red sandstone was noticed, and the same remark may be made on it here, although there is not the same access to it throughout its whole extent, since the lowermost surface is invisible. With much labour and patience a tolerable approximation to the real thickness might here be made, by following the beds slowly along the shores and sides of the hills; but I know not that any useful purpose would be accomplished by such an estimate.

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* Plate XIX. fig. 5.

From the hill last mentioned, the sandstone continues, first along the northern shore, and subsequently along the north-western, to near the western point of the island at Bridianoch, where it disappears. From the northern and north-western shores, as far as Kilmory, and beyond that, it extends backwards into the country, with characters similar to those which it has near Loch Scresort; forming a range of hills, comparatively low, but rising to the height of at least 800 feet. The boundaries, for want of accurate points of reference, cannot be rigidly defined, but the map will give a general idea of its extent. Approaching the western point of the island it occupies considerably less space, and at length barely skirts the shores; the interior prolongations being concealed by the overlying rocks. Its inclination here changes, the angle becoming much greater; while the direction also varies. This alteration is easily seen at Giurdil, where it rises to an angle of forty degrees; that angle becoming still higher under Scuir more, where this rock at length terminates. The beds are here much traversed and somewhat disturbed by veins of basalt, which in the progress of decomposition have left in them remarkable arches and caves. They are also traversed in the same place by one vein of augit rock, a substance forming a considerable portion of this island. The sandstone undergoes in the same place some changes of character which it is requisite to notice. It is intersected by numerous veins of white calcareous spar, varying from the dimensions of a thread to an inch or more, and sometimes almost equal in quantity to the including rock. In other places it becomes micaceous, and splits into thin and straight schistose laminæ; while in a third it adopts a columnar mode of fracture, and is separated naturally into masses resembling fragments of basaltic pillars.

That portion of the sandstone which is found beyond Glen Debble follows the schist in a similar manner, but with a dip nearly the reverse of that just described. It may be traced on the side of Ben more to perhaps one fourth, or more, of its height. Along the shore its course is but short, since it suddenly disappears at a point between Papadil and Glen Debble. Here the strata terminate abruptly against the trap, and are much disturbed; this rock appearing both above and below the broken ends.

From this description of the stratified rocks that form the basis of this island, their analogy with the series of rocks described in Sky is sufficiently apparent; and is such as to leave no rational doubt respecting the common position and geological continuity of the strata of both these islands, however interrupted by the deep sea which separates them.

On the basis of sandstone thus described, there are placed three or four different kinds of rock; two of which at least are of different dates, since their relations are in many places perfectly apparent, and their order in relative position is easily ascertained. They may all be considered as appertaining to the trap family, using the term in its most general sense, and they present appearances of considerable interest.

On the east side of the island and immediately incumbent on the sandstone, is observed a great body of augit rock, which although it occurs in other parts of Scotland, and is mentioned on several occasions in this work, is no where else so conspicuous and abundant. It varies considerably in aspect, being sometimes of a small granular texture, and scarcely to be distinguished from common greenstone. Some of these specimens, however granular, break in directions parallel to one or more faces of a large crystal, all the minuter faces of the augit which form the fractured surface, reflecting the light at the same angle. In other places the rock is large grained, the crystals, or grains of each substance being of considerable size, and distinctly aggregated. In this case it often forms a beautiful compound, from the strong contrast of the two minerals; that beauty being much increased where the felspar is glassy, as it generally is on the highest summits of the two hills Halival and Haiskeval. Sometimes the felspar predominates over the augit, at others the rock is a mere mass of crystallized or compact augit. The augit varies in colour, from a dark olive green, to an intense black. Occasionally hornblende enters into the composition, and in certain cases becomes so prevalent that the rock passes into common basalt or into greenstone; while in others the augit itself is so gradually excluded and the felspar so far increased, that it passes into syenite, or into compact felspar. In a few instances brown mica occurs in the compound. The changes into syenite being the most interesting will be noticed more particularly hereafter.

Tracing this rock from the place above mentioned, it is found forming the summits of Halival and Haiskeval, as well as many of the lower eminences in the neighbourhood. Its greatest extent is toward the eastern side of the island, where, besides the hills already mentioned, it appears to form the whole of the upper part of Ben more. That opinion is founded on the general aspect of the mountain and on the nature of some detached fragments, the weather having prevented me from ascending it; yet no error will probably be committed by adopting this conjecture. Under various interruptions, which will be noticed more properly when describing the trap, it extends to a considerable distance in the interior of the island, and at length terminates its course on the shores of Harris. It is difficult to trace in it any appearance of regularity as it occurs in the mountains; although it has a tendency to the same obscurely bedded disposition as is observed in other rocks of the trap family. But on the shore now mentioned it assumes a regularly bedded form, being disposed in thin horizontal strata, among which are interposed equally thin beds of a rock resembling basalt in its general characters, but which a narrow inspection will discover to contain augit as a constituent part. There is here an evident transition from this rock to an apparent basalt; while both the substances in their best marked characters pass from a distinctly stratified into a massive and amorphous disposition.

Immediately where this rock ceases a new one appears, forming the remaining portion of the western mountainous part of the island. This is a syenite similar to that described as constituting a large portion of Sky, as well as of Mull and St. Kilda. In general, its mineral characters so perfectly resemble those of the rocks now alluded to, that it is superfluous to notice them. In some few places indeed it possesses a peculiarity of character which will be better described when its connexion with the neighbouring rocks is traced.

It occupies the whole of the coast from Harris to the point of Bridianoch, rising into perpendicular and broken cliffs of at least 500 feet in altitude. These are skirted at the foot by a low projecting terrace of rock, resembling the berm in fortification, against which a turbulent swell is for ever breaking. I can only conjecture that this terrace is formed of the same rock as the cliffs, since no boat can approach, and it is accessible only in one place from the shore. At the point of Bridianoch this syenite is elevated to an angle of about sixty degrees, being disposed in distinct beds. Proceeding eastward, these become insensibly bent, and at length assume a horizontal direction; till, near the shores of Harris, they lose all form, and terminate in an irregular mass. It has a tendency to a columnar fracture at right angles to the beds, which, where the bed is horizontally disposed, puts on in some places the appearance of regular columns.* In the interior, this rock extends far to the north-east, forming the entire mass of the long irregular mountain Oreval, and its dependency Fiunacra, of nearly equal height but of far less extent. These hills have a round smooth outline; unlike Halival and Haiskeval, which are very acute and rough. Their declivities are overwhelmed with fragments, of which the progress downwards has formed the alluvial terrace already mentioned as existing at Harris.

It is now necessary to inquire into the relation which the syenite bears to the stratified rocks before described. Where its junction with the sandstone ought to take place, the land is absolutely inaccessible, since it lies in the high cliffs about Bridianoch; while it is also at too great a distance, considering the similarity in the colour and disposition of the two substances, to admit of being perceived from below. The spectator indeed passes from the one rock to the other, in skirting the coast in a boat, without perceiving the transition, and does not readily discover that he has quitted the sandstone and is contemplating the syenite. Nor could I in any other part of the island find out this junction, since the soil is deep and covered with a thick coating of moory plants on the interior declivities of the hills. Its connexion with the augit rock, is however sufficient to prove that, like this, it reposes immediately on the sandstone; were any proof necessary of the generally overlying position of this rock.

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* Viewing it from a vessel as I sailed past in a dark and stormy day, I was misled by this circumstance to pronounce it a basalt, in a slight notice of this island formerly inserted in the Geological Transactions; an error which I am glad thus to correct.

The connexion between the augit rock and the syenite is of an unexpected nature, and it was not till after a careful examination that I was satisfied respecting it. The subsequent examination of analogous transitions in Mull and in Arran, have entirely removed all doubts on this subject, and confirmed the gradation subsisting between the ordinary traps and the syenitic rocks. It was before remarked that the augit rock assumed a stratified form on the shore of Harris, and was disposed in thin beds alternating with a rock resembling basalt, but of which augit formed a constituent part. Suddenly, and without well seeing how this stratified rock disappears, it is found replaced by great masses of syenite, having at this particular place no tendency, or one scarcely visible, to that bedded disposition for which it is so remarkable in the cliffs near Bridianoch. By carefully and repeatedly following the stratified rock, it is at length discovered that there is a regular transition from the one to the other; the augit rock at first becoming finer grained, and acquiring a greater proportion of felspar, which gradually increasing, ultimately produces the syenite. Occasionally, the transition is a little more rapid, and although no decided line will be perceived on breaking the rocks at the place of transition, the different modes in which the several sorts weather, point out the place where the change is effected. In no case however is there any discontinuity or interruption in the masses, which, in their external forms, pass into each other by the most insensible gradation. This change in the forms is even more remarkable than that in the composition, the thin and numerous beds of the augit rock passing into the massive syenite by imperceptible degrees.

I have given to this rock the name of syenite on account of its general resemblance to the syenites which in similar circumstances are associated with the ordinary traps, and because there is at present no term by which it can be designated. It ought however to be distinguished by an appropriate name, since the ingredient united to the felspar is, in this case, augit, and not hornblende. But this is only one of many desiderata in the arrangement of the trap rocks, and I shall hereafter take an opportunity of examining this part of the subject in one collective point of view.

From the facts now stated, some general conclusions may be drawn that are of importance in the history of this family. The first of these relates to the imperceptible transition from the massive and amorphous to the laminated or stratified structure; and it may perhaps throw light on some obscure points respecting those trap rocks which appear to be regularly stratified. As far as relates to those that alternate with the common stratified rocks, there is nothing to add to the remarks deduced or deducible from the phenomena described in Sky and in Egg. But in many instances an apparently stratified disposition exists in them where no such alternation takes place; an example of which will be found in the account of Bute. These are illustrated by the present case, and are probably equally independent of a real stratification; using that term in its most proper sense, as the result of a deposition either from solution or suspension in a fluid. It is easy to conceive how an amorphous mass may in certain cases put on the semblance of stratification, but it is not so easy to imagine that a substance deposited by either of the processes above mentioned should in one place be regularly disposed in thin beds, while in a neighbouring and continuous portion it should form irregular mountain masses like those of the island under review. As the same mass of rock may thus be disposed in both these forms, it will follow that if a stratified and an unstratified rock of the same mineral composition should occur in different places, their difference of disposition is no proof that the periods or causes of their formation were different.

In the next place it is plain that the same rock (geologically considered) may in its different parts possess a different mineral composition; since on the one extreme of this rock, which forms a single deposit, is found augit alone, and on the other felspar. Similar changes occur in some of the trap rocks; basalt or greenstone being in many cases portions of a common deposit, of which syenite, porphyry, or compact felspar is the other. The observations made in Mull and Arran, hereafter to be described, confirm the truth of this statement. The change is not greater in the one case than in the other; and it is as easy to imagine the hornblende to be excluded from a common mass of hornblende and felspar, as that the augit should, as in this instance, disappear. It is true that geologists have admitted these several rocks to belong to one collection of overlying substances, but it has still been often imagined that there were essential differences either in their relative ages with regard to each other or in the nature of the stratified rocks which they accompanied. As far as any evidence to be derived from the phenomena visible in the Western islands is valid, there is no ground for this supposition; the several varieties, or species of the whole tribe appearing in most, if not in all, the instances examined, to be associated by a common set of geological relations.

The last conclusion to be deduced from these facts relates to basalt. Notwithstanding the trouble which mineralogists have taken to describe and limit this substance, it is as yet incapable of being defined by any number of characteristic properties. The difficulty is insurmountable, since it consists in the very essence of this rock, which, like many others, possesses neither an invariable aspect, nor a steady chemical composition, and is moreover in a perpetual state of transition into other analogous substances. To refer to any authenticated specimen is in this case no remedy, since the access to that must always be limited; besides which, an appropriation so rigid would exclude the far greater proportion of specimens, and generate a necessity for a number of additional terms. In the instance just described I have been obliged to apply this term to the fine grained dark rock, which is indeed undistinguishable by any mode of definition. Yet there is reason to suppose, from its situation among the decided augit rocks, and from the crystals of that substance which it contains, that like those it is compounded of augit and felspar. It is possible that some ready method may hereafter be discovered of distinguishing this compound from one of hornblende and felspar, which seems in the opinion of mineralogists to constitute the genuine basalt; but at present there is no criterion by which it can be certainly recognised. It must therefore be suffered to remain a point for future consideration, and I shall only remark further, that the basalt of Staffa will hereafter be shown to possess some characters giving reason to suspect that it is composed of the same materials.

I am under the necessity of describing the next of the overlying rocks found in this island under the vague and general name of trap, though it exists in several different forms.

On the sides of Halival and Haiskeval it is found intermingled with the augit rock in large masses, nor could I after much research determine the precise nature of the relation between them. The character of this trap varies in different places. Sometimes it is a common greenstone, at others a dark blue hard claystone, or a basalt, while in still other instances it is porphyritic. In one place there occurs a mass of which the weathered surface displays distinct imbedded fragments of the same rock, although, on breaking it, this appearance is barely perceptible. This occurrence is common in the analogous rocks which form the summit of Ben Nevis. In another place there is a still more remarkable mass, consisting of an ordinary dark basalt with fragments of the red sandstone scattered at considerable distances through it and varying from an inch or two to a foot in diameter. It is by no means common to find trap veins entangling fragments of the rock which they traverse, and still less, fragments so minute as those which are to be seen in this example. It is a circumstance of material importance in the history of trap, and analogous instances occur in the island of Muck, as well as in Seil and Bute. In some specimens of a German basalt, with the locality of which I am not acquainted, I have observed a similar appearance, but even more interesting; since the imbedded bodies consist of fragments of schist converted into porcelain jasper.

Notwithstanding the difficulty of determining the exact nature and connexion of these masses, it is probable they are portions of large veins, which the ruined and encumbered nature of the surface does not permit to be traced to any great extent. The reasons for this belief are, that numerous and distinct veins occur throughout the rocks in question; of a small size, consisting precisely of the same varieties, weathering in the same manner, and breaking into fragments of similar shape. This trap therefore is posterior to the augit rock and syenite, although it cannot properly be called superincumbent.

But a great body of trap, independent of this and perfectly distinct from it, both in external character and composition, is also to be seen forming a very large portion of the island. It is among the uppermost of all the rocks, and many opportunities are afforded of tracing its superiority, if the requisite attention be not wanting. It forms the summits of some nameless hills which lie to the north and east of Baikeval, where it reposes on the augit rock; and it also constitutes the chief parts of Baikeval, Arsteval, Tralival, and Rishinish, if not the whole of some of these mountains. Its superiority of position may be traced at the foot of these hills in different places. In extent, as well as disposition, it differs entirely from the trap just described, since it forms independent mountains. Portions are also found scattered here and there among that trap and the augit rock; and in these situations the contrast between the external aspect of the two is very striking. The variety first described is invariably covered with grey lichens, and breaks into the most common forms assumed by those traps which are not columnar. But the rock in question has every where the aspect of rusty iron, no lichen or vegetable matter attaching itself to the surface; and by this character it can be distinguished at a great distance. It gives a singularly barren and desolate look to that part of Rum which it occupies; and in this respect, as well as in its russet hue, strongly reminds the spectator of the naked and sterile appearance of Loch Scavig. The natural fracture of this rock is also quite different from that of the former, and is indeed exceedingly remarkable: it is best observed in the smaller hills. The general mass appears in these to consist of an aggregation of huge protuberant bodies, each having its own curved surface. This surface is cracked throughout into large polygonal forms, varying in the numbers of their angles. The fissures which separate these polygons are three or four inches in breadth on the surface, but approximate as they descend deeper. When therefore a vertical section of these hills is examined, the polygonal masses will be found in contact at a certain depth, the intervals always widening as they ascend. The polygons are easily detached at the surface, and appear in the form of flat slabs, such as would be used for paving; while nearer the imaginary centre of the mass, they put on the semblance of frusta of pyramids, rather than that of the joints of basaltic columns, to which it is obvious that they have a near affinity. No drawing can give an adequate idea of this strange appearance, but a conception of it may be formed by supposing that a fluid substance had congealed at the surface, while the internal parts were still in a fluid state; and that the crust thus formed had been broken into fragments by the expansion of the central parts. Similar appearances can in fact be produced by the cooling of certain metals and other bodies from a state of fusion. Whether from the greater novelty of this appearance, or its more extraordinary aspect, it produces a more striking effect than any other basaltic display which I have witnessed. The uniformity of the surface, the depth of the fissures, the magnitude of the polygons, and the great scale of the whole, together with the decision of the parts, give it an aspect resembling much more a gigantic effort of art than the columnar pavements either of Staffa or of the Giant's Causeway. The resemblance which it bears to the argillo-calcareous septaria will, on a general view, suggest itself to an observer; but it is necessary to remark that this set of fissures is arranged in a reverse order, the widest intervals lying on the outside. It is unnecessary to inquire how far it is connected with the theories respecting the formation of trap, as the analogies will be obvious to every geologist.

This rock is remarkably sonorous when struck, rendering a sound precisely like that of iron. It is of a dark blue colour and minute granular texture, containing augit dispersed through it in a particular form, which I have already mentioned as occurring in the Shiant isles, as well as in the granular augit rock of this island, and which can in no way be so well described as by comparing it to the skeletons of large crystals. In a fortunate fracture the indication rather than the solid substance of the crystal is visible; when broken again, perhaps the whole disappears. This peculiarity seems to arise from a general polar tendency in the irregular and minute crystals that form the mass, causing them to affect that disposition which, acting on the molecules at liberty, would have constituted a perfect crystal. Thus the lamina of the crystal may be distinctly seen in the laminæ of the smaller parts, while its perfect continuity is at the same time interrupted by the unevenness arising from the partial independence of these parts. In other instances it would seem as if numberless minute crystals or grains of the rock had been enveloped in a crystallizing base; the case being here analogous to that of the well known arenaceous spar of Fontainebleau. Although I have enumerated this rock among the common traps, as if it was ascertained to consist of hornblende and felspar, there seems much reason to suspect that, like the fine grained rock at Harris already described, it is also a mixture of augit with the latter substance. This opinion is founded on the imbedded crystals of augit which it contains, on its high specific gravity, its very sonorous property, and the great resistance it offers to decomposition, the last being a character in which most varieties of augit rock agree. But it is so difficult to distinguish augit and hornblende when in this state of minute aggregation, that I shall be excused for leaving this matter undetermined.

All the rocks, the sandstone, the syenite, the augit, the trap, and even the basaltic veins thus described, are traversed by a second set of basaltic veins. These are often minute, not exceeding an inch in breadth, but very persistent. They are of a very fine grain and nearly black; and are easily distinguished even in their courses through the first set of veins, by their resistance to decomposition.

While on the subject of basaltic veins I must not omit to mention a very remarkable one to be seen on the shores of Loch Scresort. It is, I believe, universally supposed, that in all the columnar veins the direction of the columns is at right angles to that of the vein. In this, their direction is parallel to it, and their position horizontal. The vein itself is of considerable size, and is divided into columnar masses of an irregular shape, of which four, five, or more lie laterally in its thickness; while, in its direction, they are separated into rude joints of irregular lengths.*

Having described these most prevalent of the trap rocks found in Rum, it is still necessary to enumerate one or two which cannot be referred to either, and which bear a greater resemblance to the stratified traps of Sky and Canna, than to those already examined. They are found on the north-western side of the island. One of these is seen in detached masses on the north-western summit of Oreval, from whence it extends towards Kilmory; being clearly incumbent both on the syenite and on the sandstone, according to the different places which it occupies among the hills. It has a flat surface and a prismatic fracture; bearing, in these respects, no resemblance to those at the eastern side of the island, and having no other common feature with them but that of containing augit as a part of its composition. The other is incumbent on the summit of Creg na Stiarnin, reposing on the sandstone; and its abrupt face, distinguished by the name of Scuir more, is well known as the repository of the heliotrope for which the island of Rum has long been celebrated. It is partly basaltic and partly amygdaloidal; a judgment only formed from the inspection of fragments, since it is I believe every where inaccessible. These masses have a nearly common character, both mineral and geological, and may safely be considered as one deposit; but I doubt much if it is possible to obtain any evidence by which to determine the relation which they bear to the trap described before. The differences are as great as those already mentioned between the mountain trap and the stratified trap of Sky. Did they approximate in any place, some assistance might be procured in solving this question, but I believe that there is every where a geographic interval between them. It is fruitless to accumulate conjectures, but it is not useless to confess ignorance, since it will point out to other travellers the blanks to be filled, and the errors to be corrected; while I may state in the words of St. Augustin my conviction that in this science also "Melius est dubitare de occultis quàm litigare de incertis."

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* The rarity of this occurrence induces me to mention a similar instance which is found on the west side of the Mull of Cantyre. In this case the columns are also parallel to the vein but in a vertical position.

It has been said that the transverse disposition of the columns in trap veins originated from the same cause as their vertical one in ordinary cases; namely, from the cooling having commenced at that part which in both cases must be considered as the surface. The present instance will not admit of this explanation, nor is it more applicable to the masses of columnar rock on the eastern side of Staffa.

In concluding this description of the rocks which form this island, I do not imagine that any material points have been omitted; but, if there are such, they will be found in a curved line between Loch Scresort and Giurdil, at the inner edge of the sandstone. They are thus pointed out for the correction of future observers. I have indeed been informed by the inhabitants that coal similar to that of Canna has been found in this part of the island. I did not see the place, but it probably exists in some of the trap rocks last described.

IT only remains to describe the rocks out of place, and the independent minerals.

On the shores of Harris there are some fragments of porphyry, with a felspar basis of a brown purple colour, which by their position seem to have descended from

Arsteval or Traleval. I also found pieces of a reddish felspar porphyry on Oreval, of which the place was probably not far off, since they were near the summit.

On the beach under Scuir more, fragments of two kinds of pitchstone occurred, the one of a black, the other of an olive green colour; but whether from the sandstone or the basalt it is impossible to determine, since these are both far out of reach. There is nothing in the mineral character of either which demands a detailed description.

It is only among the fragments on the same beach that the heliotrope can be procured, large quantities of it falling together with portions of the rock in which it is imbedded. This beautiful mineral is not peculiar to this part of Scotland, since I have found it in the hill of Kinnoul, in Kerrera, in Mull, and in Ayrshire. But it offers here a considerable number of varieties, the principal of which it will be useful to describe, because they point out so clearly the origin and composition of this mineral, which I have formerly shown* to be a compound of green earth and chalcedony. The chalcedonic basis itself varies in aspect and composition, and thus proves a fundamental cause of variety in the appearance of the heliotrope; being at times of the most usual character, while in other cases it tends on the one hand to quartz, and on the other to chert. Hence the fracture of the heliotrope is sometimes sharp and conchoidal, with the lustre of resin, while at others it is earthy, or resembles wax. The series of colour which is here found among the specimens, renders it easy to trace the progress of this mineral from common white chalcedony, or from chert, to the deepest green heliotrope; according to the proportions of green earth which it may contain. At first the basis is slightly tinged, either partially or generally, with green. This by degrees increases, passing through various shades of pale and blueish green until it terminates at last in a colour so intense as scarcely to be distinguished from black. The clouding and mottling of these several tones of colour by intermixture with each other and with different tints of brown, give rise to still further varieties. In some specimens the green earth, which is the cause of the colour, is found imbedded in the stone in small nodules, similar to those which so often occur in amygdaloids; in others it is to be observed in the natural rifts. I may add that one specimen occurred so transparent as to resemble plasma; but I am uncertain if mineralogists will allow it to be ranked with the genuine specimens of that rare substance.

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* Geological Transactions, vol. ii.

The green specimens are often intermixed with brown, and pieces are also to be seen which are brown throughout. I have compared specimens of this variety with that substance brought from the East Indies by the name of brown carnelian, and found a perfect resemblance. This stone is said to be rare, and is much valued by lapidaries: its origin is probably the same. Occasionally the green colours are intermingled with orange and brown; more rarely with dark red spots, in which case they resemble that variety called oriental, commonly known by the name of bloodstone.

This mineral is sometimes speckled with crystals of pyrites, which are very often found decomposed and of a rusty brown colour, rendering the stone carious, and entirely depriving it of value as an ornamental substance. It also frequently contains minute globules of a white substance, which turns dark on exposure to the weather, and appears to be brown spar; although it is difficult to speak positively of minerals so very minute. Sometimes it is intimately mixed with laminæ of calcareous spar, often so numerous as to equal in quantity the remainder of the stone; and as, on being broken, it yields in the weakest parts, it seems on a superficial view to consist entirely of that substance. With respect to its connexion, it is disposed in nodules or in fragments of veins of various sizes, being at times imbedded in an amygdaloid, and at others in a basalt.

Nodules of pale onyx agate are also found among the substances which fall from Scuir more, but they are neither abundant nor remarkable for their beauty, except where, as sometimes happens, they are partially stained with green. Among them I procured one specimen of an uncommon appearance, consisting of fragments of highly brilliant charcoal involved in white chalcedony; a portion, probably, of some mass of imperfectly silicified wood. The aspect of this charcoal is peculiar, since it has the lustre and apparent compactness of jet in the longitudinal fracture, while it is so soft as to yield to the nail; but its fibrous texture and ligneous origin are easily traced in the cross fracture.

Another specimen is of considerable interest, as it throws light on some disputed questions relating to the origin of the agate nodules which occur in trap. It is scarcely necessary to say that these have been attributed to two distinct causes; the one a secretion of the siliceous matter during the hardening of the trap from fusion, and the other a posterior infiltration of a watery solution of silica in cavities previously existing in the rock. If the former cause be considered the true one, it necessarily follows that the rocks which contain them have been in fusion. But if the latter be supposed their true origin, it does not by any means follow that these rocks are the result of a deposition from water. The argument therefore which may be deduced from these nodules, on either hand, proves nothing with regard to the containing rock, since, whatever its origin may be, it will appear, from the consideration of this and other phenomena, that the nodules are in many, if not in all cases, posterior to the rock, and formed by a watery infiltration of the substances which they contain. Still it must be remarked, that the existence of the original cavities in the trap is conceivable only on the supposition of their igneous origin.

It was formerly shown in a paper on the hill of Kinnoul,* that agate nodules are sometimes found containing cavities in which stalactites of chalcedony depend from the upper part; and that in other instances, of which Faroe produces numerous examples, there is found a distinct stratum of horizontal and laminar chalcedony filling the lower side of the cavity; sometimes rising in its progress so as to entangle the dependent stalactite, and finally in certain cases involving the whole. It can scarcely admit of a doubt that the siliceous matter has in these instances been deposited in a gradual manner from a watery solution, since in one or more of such nodules all the stages of the progress can be traced. In some, the whole cavity is filled with solid matter, while in others the process appears to have prematurely terminated, a cavity remaining. The causes of this are to be sought for in some change of the rock itself, refusing further passage to the silicated solution; and however difficult it may be to explain this change, it is by no means uncommon in the case of calcareous infiltrations; which are sometimes found to have ceased entirely, from the rock no longer admitting the transudation of the calcareous solution. A fact of this nature is pointed out under the head of Lismore.

It is well known that calcareous spar is frequently found in the centre of the agate nodule, sometimes regularly crystallized within the unfilled cavity, and at others occupying all that space which the chalcedony has left. In some cases it impresses its form on the chalcedony, while in others it is impressed by that substance. The present specimen illustrates these appearances. It is a pale zoned agate (onyx), from one side of which, to be considered doubtless as the upper, stalactites of the same substance depend.† That part of the nodule which is not siliceous is partially filled by calcareous spar, so as partly to involve the stalactite. It is obvious, from considering the structure of this nodule, that, as in the cases occurring at Kinnoul, the stalactite has been first formed in the cavity, and that by a subsequent infiltration of carbonate of lime, the calcareous spar has crystallized within the remaining vacancy. The joint existence therefore of chalcedony and calcareous spar in a nodule, must not be considered as an instance of the separation of the one substance from the other during the act of cooling, but as arising from the subsequent infiltration of one substance into a cavity partly occupied by another. The relative times of these infiltrations will account for the different relative positions occasionally occupied by the two substances, as well as for the circumstance of their alternately impressing each other; while the cessation of the process before the cavity was filled, will explain how the calcareous spar sometimes possesses a geometric external form, when at others it is deprived of that. It is no objection to this view of the case, that the calcareous crystal is often entirely surrounded by the chalcedony, since a soft state of this substance, admitting the transudation of water, must have equally existed to admit the formation of the siliceous stalactite itself, and since it is known that common flint when first removed from its native bed permits water to exude from its surface. In the instance also of quartz veins, as well as in the calcareous veins of schist, abundant examples occur of their formation in hard rock, in consequence of watery infiltration. It need scarcely be added, that the existence of water in similar agates, a fact mentioned by Dolomieu and others, is easily explained on this view.

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* Geol. Trans. vol. iv.

† Plate XXX. fig. 2.

The abundance of augit in this island would lead us to expect specimens of it in distinct and independent forms; but I did not meet with any; no cavities among the rock, in which only we can expect to meet with such crystals, having occurred. The largest crystals which I observed were imbedded distinctly in glassy felspar among the rocks of Halival. They were about two inches in length, and half an inch in thickness. The same mineral is sometimes found in that concretionary state which is known by the name of coccolite. In this case it is usually of a pale olive green, and translucent. Another remarkable mixture occurs, namely, that of the coccolite with the laminar and massive augit. In this case the same appearance takes place which I have described as occurring in the granular rock; the laminar portions persisting in continuous faces every where interrupted by the interposed coccolite, and thus acquiring an aspect somewhat similar to that of graphic granite. In one instance there occurred cavities in a trap vein where a felspar of an olive green colour was traversed by large crystals of black augit. The olive green augit is also met with in two other states. In the one it appears in the form of a crowded mass of crystals without any felspar interposed, and considerably translucent. In the other it constitutes a solid mass, with an irregularly plated fracture; being so tough that the hammer of four pounds weight was almost incapable of detaching a fragment, or breaking one already detached. The green hue of this mineral is less common than the black, the most numerous specimens appearing to be of the latter colour; in which case, when they form rocks, it is very difficult to distinguish them from hornblende.

In the neighbourhood of Harris I procured some specimens of hypersthene, a substance already described as existing in Sky. In mineral character it is not to be distinguished from the specimens of that island, and it occurs in compound veins traversing the augit rock. It did not appear to constitute any portion of the rocks in the vicinity of the veins, as it does in Sky. The vein is a nearly equal compound of opake white felspar and hypersthene, the latter forming concretions of an inch or more in length. It is by no means abundant in this place.

This hypersthene is accompanied by a mineral, also rare, and hitherto unobserved in Scotland; namely, apatite. The crystals are very minute, not exceeding half an inch in length and as slender as a pin, but perfectly characterized. The position of this mineral is analogous to that which it sometimes occupies in volcanic rocks, in which however it is by no means common, having hitherto occurred chiefly in the primary rocks, in granite, gneiss, and micaceous schist.

I may add, that dark felspar, similar to that of Labrador, and brown mica, are occasionally found in the same vein.

In the heliotrope, cavities of a large size are sometimes found, filled with an opake green calcareous spar; presenting a very uncommon variety of that substance, and, like the chalcedony, apparently coloured by the green earth.

The last mineral which remains to be enumerated, being hitherto undescribed, it is necessary to enter into a minuter detail respecting it. Many years have passed since I discovered it, both here and in Fife; and the description has been hitherto delayed in hopes of finding larger specimens, better adapted for elucidating its history. These hopes have hitherto been disappointed, and I must therefore give it, however imperfect; in hopes that other mineralogists will hereafter supply the deficiencies. When recently broken it is of a green colour; varying from the transparent yellow green of the finest olivin, (or chrysolite) which it sometimes resembles so as to be undistinguishable, to the dull muddy green of steatite, to which in this case it bears an equal resemblance. In a few hours after being taken from its repository, or exposed to the air, it turns darker and shortly becomes black; a change which also occurs within the rock at the depth of an inch or more from the surface. In this case the transparent variety puts on the external aspect with the lustre of jet; while the opake one preserves its dull surface and more nearly resembles black chalk. Notwithstanding this change the mineral when in small fragments still continues to transmit light. The first variety remains perfectly translucent and presents in some specimens the fine brown orange of cinnamon stone, in others a rich bottle or olive green. The other appears also of an olive green, but is not more translucent than wax of the same thickness. When powdered, the one is of a snuffy brown; the other, of a dirty olive. The fracture of the first variety is generally conchoidal, that of the second is commonly intermediate between the conchoidal and granular. It is so soft as to be scratched by a quill, and is brittle; easily breaking into minute irregular fragments. The specific gravity is 2,020.

With respect to its chemical habits it remains unchanged before the blowpipe; neither cracking nor sensibly altering its colour or translucency. It is apparently as refractory as quartz; a remarkable circumstance, when the quantity of iron in it is considered. It is acted on by muriatic acid, giving indications of a considerable proportion of iron, with a little alumina; but the principal constituent appears to be silica. There are no traces of lime or of manganese. The very minute quantity I possessed for examination prevents any more accurate detail of its composition.

It is found imbedded in the amygdaloids of the cliffs of Scuir more, the base being either a basalt, or a black indurated claystone. The nodules are generally round and vary from the size of a radish seed to that of a pea or upwards. Occasionally they are oblong and compressed, and sometimes scale off in concentric crusts. In a few instances they are hollow within, the interior surface having a blistered aspect; or else the cavity of the amygdaloid is covered with the substance in a form resembling that of an exudation. More rarely still the nodule is compounded, containing a spherule of calcareous spar within an investing crust of the mineral. When long exposed to the air it decomposes in the form of a rusty powder, which is thus occasionally found filling those cavities that are visible on the surface of the fragments in which it is found. The variety from Fife differs from that of Rum in being less regular in form, and less frequently round, while it is commonly also of a larger size. From the most characteristic quality of this mineral, the term chlorophæite may be conveniently adopted to distinguish it.*

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* Since this work was prepared for the press the same mineral has been brought from Iceland by Major Petersen. It is similar in all its characters to the specimens from Rum, but the nodule is of three or four times the bulk. It is probable that, like other new substances, it will prove less rare as the attention of mineralogists shall become directed to it.

Considering our yet imperfect acquaintance with minerals, and the uncertainty of the characters by which we are still compelled to distinguish them, it may possibly happen that the substance above described may hereafter prove but a variety of some established mineral. At present however its discriminating characters are strongly marked, while the only chance of future investigation will be derived from giving it a conspicuous place in the list. Mineralogists will recollect how long many substances of highly distinct characters were neglected, because overlooked among the supposed varieties of some acknowledged species.

EGG.*

Although this island is of easy access, and presents one of the most interesting and picturesque spots in the whole circuit of the Western isles, it continues nearly unknown to the southern travellers who for so many years past have made the Highlands the object of their summer excursions. An excellent road now leads from Fort William to Arasaik, enlivened by the most various and romantic scenery, and rendered otherwise interesting to those who cannot tread unmoved on that ground which has been the seat of important events. On the shores of Arasaik was landed the unfortunate Prince of whose subsequent adventures so many remembrances are to be found in the places described in this work; and in Glen Finnan was first erected the fatal standard, of which a record is now to be seen in a recent monument bespeaking the affection, rather than the taste, of the founder. The voyage from Arasaik to Egg is short and easy, nor need the tourist encounter one half of the difficulties and delay in this expedition which he is sure to experience in his attempts to visit Staffa. Whoever may hereafter be induced to profit by these hints, will have reason to be thankful to the remarks which have tempted him to prolong his excursion thus far, and will not regret the few days he may bestow in visiting this neglected spot.

The columnar ranges so common in the Western islands, present nothing of a character in the least similar to those which occur in Egg; even to him who may have been satiated with the regularity of Staffa or the magnificence of Sky, this island offers both variety and novelty. With that novelty it combines a grandeur and peculiarity of feature yielding to nothing in the whole circuit of Highland scenery; and incapable indeed of being compared with any other elsewhere, since unlike to any thing which has ever yet been delineated by artists.

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* Eg, an edge, Danish; a name very expressive of the appearance of this island. See the Map.

Although the shores of this island present many striking objects and much grandeur of character, the chief interest lies in the towering rock called the Scuir, which forms the highest summit of the land on the southern side.* The height of this extraordinary object is considerable, yet its powerful effect arises rather from its peculiar form and the commanding elevation which it occupies, than from its positive altitude. Viewed in one direction it presents a long irregular wall crowning the summit of the highest hill, while in the other it resembles a huge tower. Thus it forms no natural combination of outline with the surrounding land, and hence acquires that independence in the general landscape which increases its apparent magnitude and produces that imposing effect which it displays. From the peculiar position of the Scuir it must also inevitably be viewed from a low station. Hence it every where towers high above the spectator; while, like other objects on the mountain outline, its apparent dimensions are magnified, and its dark mass defined on the sky so as to produce all the additional effects arising from strong oppositions of light and shadow. The height of this rock is sufficient in this stormy country frequently to arrest the passage of the clouds, so as to be further productive of the most brilliant effects in landscape. Often, they may be seen hovering on its summit and adding ideal dimensions to the lofty face, or, when it is viewed on the extremity, conveying the impression of a tower, the height of which is such as to lie in the regions of the clouds. Occasionally they sweep along the base, leaving its huge and black mass involved in additional gloom and resembling the castle of some Arabian enchanter built on the clouds and suspended in the air.

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* Plate V.

The appearance of artifice is most apparent when this rock is viewed at the eastern extremity, where the form resembles exactly that of a ruinous tower; of gigantic dimensions, since the altitude is not far short of five hundred feet. That resemblance to architecture is much increased by the columnar structure, which is sufficiently distinguishable even from a distance, and produces a strong effect of artificial regularity when seen near at hand. To this vague association in the mind of the efforts of art with the magnitude of nature, is owing much of that sublimity of character which the Scuir presents, even when divested of the accessary circumstances produced by the accidents of light and shade and by atmospheric effects. The sense of power is a fertile source of the sublime, and as the appearance of power exerted, no less than that of simplicity, is necessary to confer this character on architecture, so the mind, insensibly transferring the operations of nature to the efforts of art where they approximate in character, becomes impressed with a feeling rarely excited by her more ordinary forms, where these are even more stupendous.

This island is of small dimensions, being only three miles and a half in length, and two and a half in breadth, and is bounded in most places by high and rocky shores, but of different characters. It appears, in a general view, to be separated into two distinct eminences by some lower intervening land; this visible distinction being accompanied by a corresponding difference in its physical character. When viewed from the west, the northern extremity presents an irregular table land, with the terraced outline and well known cliff which is always indicative of a particular variety of trap; while the southern extremity displays an irregular serrated outline, and a more uneven line of coast. Excepting the sandy bay of Lagg on the western side, the whole shore is rocky; affording no other harbour than that which is formed by the small detached island Eilan chastel, fit only for ships of small burthen. The general surface is uneven and undulating, being diversified with small hills and terraces; while towards the southern side it rises to its highest elevation at the Scuir, and on the northern to a height somewhat inferior. There is some green and arable land at the bay of Lagg, and a considerable proportion of the same soil at the eastern side, where the island gradually subsides to the sea; while, with a few exceptions of no importance, the rest of the surface consists of a heathy or mossy pasture, applied to the rearing of black cattle, which here constitutes the chief object of rural economy. The height of the Scuir from the level of the sea appeared from barometrical observation to be 1339 feet. Though the opposite elevation is considerably lower, I had no opportunity either of measuring it or of forming an accurate estimate of its relative height. This island has neither extent or elevation to admit of the accumulation of any considerable stream, possessing two or three brooks only, scarcely worthy of notice. Nor does it present any traces of alluvial or of transported matter, excepting that which forms the great slopes at the feet of the basaltic cliffs, and at the base of the Scuir; being produced by the annual waste and ruin of those rocks.

As the position occupied by the trap rocks prevents the secondary strata from being sufficiently detailed in the map, I have added such a general section of the island as will assist in rendering its description more intelligible.*

IN a general view, the island of Egg consists of a large body of trap, which, as the section shows, may be considered as forming a great bed, dipping towards the southern, and consequently elevated at the northern extremity. The sea washes the foot of this rock to the southward from the bay of Lagg to Balinakily, no other substance appearing beneath it; nor are any strata either primary or secondary to be seen throughout this whole extent. But in examining the shore from the bay just mentioned round the northern extremity of the island to the same point, numerous beds of the secondary rocks are found mixed with the trap; in an order sufficiently regular in a general view, but so inconstant in the minuter details, that no single description will apply to all the points that admit of examination. As the most perfect display of these strata is to be seen at the highest point of the northern shore, I shall enumerate them as they occur at that place; their deficiencies and obscurities in others will be the more intelligible.

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* Plate XIX. fig. 1.

The uppermost and principal bed consists of trap,* attaining the thickness of 100 feet or more, and incumbent on several strata of a white sandstone, the collective depth of which appears to vary from twenty to fifty feet. Below the sandstone is a second bed of trap, followed by a considerable series of small strata consisting of limestone alternating with an argillaceous schist that must be considered as a variety of slate clay or shale. This is again followed by basalt, which is succeeded by two distinct portions of stratified rock. The first of these is a sandstone with some peculiarity of character, and the next a series of thin alternating laminæ of sandstone and shale: the whole resting ultimately on a bed of columnar basalt about fifty feet in thickness, terminating in the water line; beyond which no further information can be procured, since the regular dipping of the whole mass commences at this point. It is owing to this dip that the uppermost sandstone, which is elevated many hundred feet at the point just described, is found reaching to the shore at the bay of Lagg, and but slightly elevated above it near Balinakily. The accompanying diagram will render this order of arrangement more intelligible. From this dip it results that the lower beds become excluded in proceeding either way from the point now mentioned; while, at the same time, they are often rendered invisible where they might otherwise be seen, in consequence of the fall of the superincumbent rocks, and the heaps of loose matter and grassy slopes by which they are covered. Hence, it becomes impossible to trace these beds for any considerable distance without interruption, and consequently to perceive the points at which they undergo the changes visible in many parts of them. I may add to this difficulty, those arising from the inaccessible nature of the greater part of these cliffs. The changes to which I have here alluded, although numerous and remarkable, are however partial, being limited to particular places; the general arrangement of the stratified rocks continuing the same throughout as it is represented in the diagram. The chief variations to be observed occur in the fourth bed in the vicinity of the bay of Lagg. At that place many other beds of trap are to be seen interposed among the limestone and shale, while some flexion of the latter may also be observed; a circumstance otherwise of very rare occurrence here, since the whole maintain a general parallelism throughout, in nearly one plane.

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* Plate XIX. fig. 1. Plate XXIII. fig. 5.

It is in this place that fibrous limestone is found; occurring in numerous thin beds mixed with common blue limestone and with shale, or (to judge from mere specimens) argillaceous schist; since this rock frequently assumes the characters of the most common varieties of clay slate. It is fruitless to attempt a description of these alternations, since they are extremely inconstant; varying indeed to the eye in the space of a few feet, and becoming complicated in so many different ways as to surpass all power of description. The fibrous, like the compact limestone, is either of a dark lead blue, or of a pale smoke colour, and rarely attains a thickness of two inches; more commonly it varies from a quarter to half an inch, many laminæ often succeeding each other in a small space. Some of the specimens present that ramified appearance of the fibres which bears so strong a resemblance to organic arrangement, and it is scarcely necessary to add, that the fibrous crystallization is perpendicular to the plane of the beds. Among the calcareous strata are found many other varieties. Some are bituminous and fetid, others contain so much sand as to pass at length into calcareous sandstone, while in a third, are found carbonized vegetable fragments, and in a fourth, shells. It is so difficult to procure distinct specimens of the latter, and at the same time to mark the beds from which they were derived, that I shall not pretend to describe the organic remains, nor do I indeed imagine that they are any where in a state to admit of being ascertained. The only distinct specimens which I could procure contain a small shell resembling a terebratula, but still deficient in the minute parts by which alone its genus could be determined. I may however remark, that they are so perfectly identical with those of the upper beds of Trotternish in Sky that they cannot be distinguished on comparison.

Among the sandstone also, are two varieties particularly requiring notice. One of these contains thin laminæ and fragments of coal; alternating, like many others of the lowermost beds of this rock, with some of the calcareous strata. It is among these alternations that those mixtures of calcareous and sandy matter are to be seen which may either be called calcareous sandstones, or siliceous limestones, as either substance happens to predominate. But here, as in the calcareous strata, it would be an useless task to enumerate all the variations which occur, and I shall therefore conclude by describing one of the most remarkable of these sandstone beds, although not peculiar to this place, since it occurs in Sky and in Rasay, and is moreover not unfrequent in other situations where this series is found. The concretions by which it is characterized are seen either protruding from the mass of the cliff, or detached by the wearing of the surrounding parts and lying on the beach, where they remain with little sensible change. They are either irregularly spheroidal, or bounded by several portions of smaller spheroids, and consist, like the surrounding sandstone, of grains of quartz, but more strongly aggregated; having in some cases, when broken, the aspect of the more compact sorts of quartz rock. Although commonly smooth on the surface, they are occasionally cracked into irregular polygonal forms resembling those of the septaria, the cracks being wide at the surface but gradually diminishing at the bottom, and seldom penetrating to more than an inch in depth. These balls have been supposed to arise from crystallization, and to be in themselves a sufficient proof that the strata which contain them have been produced by that process. On this I shall only remark that there is a wide interval between the crystallized and the concretionary structure, whatever analogy may exist between them; and that the present is not the only variety of this mode of aggregation still unexplained, and still demanding the sagacity of geologists.

The trap rocks which are interposed among those now described, present also several varieties both of general aspect and of composition. Considerable ranges of columns are to be seen in many places, being abundant toward the east side of the island, and alternating with other forms of trap as well as with the above mentioned strata. These, as far as I examined them, are composed of dark blueish and black basalt, and sometimes contain nodules of mesotype; an occurrence not very common in basalt or in any of the more compact traps. They are often jointed, and very regular in their forms. At the extreme point of the island a considerable range, of forty or fifty feet in height, occurs at the level of the sea, the base of this rude colonnade being in different places wrought into caves of moderate dimensions. Among the columnar beds are interposed amorphous basalt and amygdaloids containing nodules of calcareous spar, chalcedony, and zeolites; the whole alternating in the usual irregular manner. In some places there are also to be seen small beds of siliceous schist, and of iron clay, substances very frequently found among the stratified trap rocks of the Western isles.

It was observed at the beginning of this description that there was a general parallelism and evenness of position to be traced throughout the whole of this mass of beds. It is in fact very remarkable, and is particularly worthy of notice, as it rarely happens but that some disturbance, fracture, or bending of the stratified rocks occurs where they are in contact with trap. In this place the thinnest as well as the thickest of the trap beds are equally parallel to the sandstone and to the calcareous strata among which they lie; those irregularities alone being excepted which proceed from the occasional extenuation and consequent disappearance of one or other of these associated strata. In the account of Sky I have described similar circumstances as existing among the beds of lias on the eastern shore of Trotternish, although the alternations there take place among masses of greater dimensions; and it was also proved that in every case of this nature there occurring, an interference is somewhere to be discovered even after a mile in length of regular parallelism had been preserved. That I did not discover such interferences in the present instance is no proof of their non-existence; yet, admitting that they do exist, there may still appear some difficulty in explaining the nature and causes of the appearances in question. This difficulty consists in the evenness preserved among alternations so numerous and strata so thin. Yet as the stratified rocks are here in no instance prolonged for any great space without some interruption and change of composition and proportions, it is probable that the intermediate beds of trap are, like those on a larger scale in other places, occasional intruding masses in the form of parallel veins, and that the whole difficulty would be solved if in this as in other instances a perfectly free and continuous access to the whole series could be obtained. The facility with which the calcareous strata admit of being separated, and the numerous divisions naturally existing between them, will also assist in explaining the peculiar disposition assumed by the intruding trap.

It is now necessary to inquire into the geological relations of the secondary strata just described. It is evident that no light is thrown on this part of the subject by the history of their connexion with the trap, and Egg presents no appearance of the red sandstone which occurs in Sky and in the neighbouring island of Rum. There is however no obscurity in their general character, when we consider the organic remains and fragments of coal which they contain, and the resemblance they bear to the uppermost secondary strata of Sky. There is every reason to suppose that they form part of a deposit scattered in an interrupted manner through these islands, and are a portion of the lias series already described. Their connexion with the trap is sufficient to account for their insulated position; nor is that indeed more remarkable here than in Sky, where the analogous substances are equally separated by masses of trap from each other and from the strata on which they would otherwise repose. In examining the general connexions of the Trap isles, I shall hereafter take occasion to bring the whole under one comparative view, and thus to supply what may yet be wanting to complete the history of the secondary strata of Egg.

Such are the appearances and the disposition of the rocks at the north end of this island. The mass of trap, as I have already remarked, extends to the opposite side, where in its dip it excludes from sight the continuation of the stratified rocks which probably lie beneath. In this division of the island it offers also less variety of structure and composition; exhibiting no where the columnar forms which abound at the northern extremity. Feeble attempts at regularity of form are indeed occasionally visible, but in general the solid varieties are amorphous, although chiefly formed of the same compact dark basalts which are found in the columnar shape in other places. They alternate with amygdaloidal beds, in which calcareous spar, and chalcedony, with its common attendant amethystine quartz, are the most common minerals. Mesotype and analcime also occur, but more rarely. The varieties of calcareous spar are not numerous, and present chiefly modifications of the primitive rhomb similar to those which occur in the trap rocks of Faroe.*

Near the cave mentioned in the subjoined note, veins of very dark fine basalt occur in abundance throughout the massive trap, which has here the several characters of greenstone, porphyry, and amygdaloid. In the same neighbourhood are to be seen the two well known veins of pitchstone, lying within a few yards of each other. Both of these traverse the surrounding rocks in a position nearly vertical. They are both exceedingly unequal in thickness in different parts of their courses; varying from the breadth of three feet or more, to that of an inch or less. They are more than once interrupted and broken off, as well as shifted, during their progress; and these changes are most visible in the westernmost. There is no union of the veins and the surrounding rock at the planes of contact. The easternmost is the largest, and is split into two parts by an intruding mass of rock which has the aspect and characters of chert; being of a light grey colour, extremely hard, sharp in the fragments, and sonorous: it contains besides a few brilliant crystals of glassy felspar. It possesses no apparent analogy either to the vein or the surrounding rock; in which respect it is however not singular, as veins of porphyry have in general, in other cases, as little reference to the substances which they traverse. This vein of the pitchstone has in some places a weathered surface, presenting a scoriform and cavernous aspect much resembling that of certain basalts. It is of an olive green colour in the centre, where it is thickest, gradually becoming of a dark blue and ultimately black at the edges. The outer parts are laminar, so as to admit of being detached in the form of large fissile plates, and I must add that the vitreous aspect is here most perfect, diminishing gradually in proceeding towards the middle of the vein. The black parts become in the first stage of weathering covered with a black powder, and can scarcely at first sight be distinguished from the most brilliant varieties of coal. The blue portions sometimes present a mealy aspect, like that of the bloom on the surface of a plum, and in this case resemble strongly a blue glass occasionally seen amongst that of which common bottles are made. Small crystals of glassy felspar are sparingly dispersed through this pitchstone. The western vein, which is the thinnest, possesses no colours but the blue and black, the latter being found, as in the eastern one, at the sides, where it is in contact with the trap: I shall hereafter point out an analogous circumstance in the island of Lamlash. No other veins of this substance have been found in Egg, but it is not unlikely that some exist about the eastern and least accessible parts of the island. This opinion is deduced from observing on the beach near Eilan chastel rolled stones of a black pitchstone porphyry, quite unlike the produce of these veins, and considerably different from the mass of that rock which forms the Scuir, the most remarkable as well as the last substance in the order of superposition.

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* Some caves of considerable magnitude are found in the trap at the south-eastern side of the island. One of these is well known as the scene of a massacre committed by the Macleods on the Macdonalds of this island during the times of petty dominion and ceaseless warfare, admirers of which are even now not wanting. The darkness which hangs over past ages, conceals the tyranny and the misery of those times, as the mists which hover on the mountain obscure its precipices and asperities; while the grandeur and the heroism of the one, are, like the altitude of the other, enlarged to the eye of fancy. He who shudders at the incursions of a Chickasaw or Mohawk tribe, the minute details of which are before him, still admires the no less cruel warfare of a Highland clan, because the circumstances which should place its atrocity full in his view are lost in the obscurity of years. In the cave of the Macdonalds, and in the unburied bones which strew its damp and obscure recesses, he may witness a proof of the horrors with which this state of society was attended. Here he may contemplate the skeleton of the last survivor of this devoted population, occupying the furthest crevice of the rock as the last refuge from the deadly smoke, and picture to himself the agony of exertion with which this ineffectual retreat was procured, until he is transported to past times, and shudders as if these scenes were again to be acted and as if he were himself to be the victim of an inveterate Macleod.

The Scuir* of Egg occupies a position somewhat easterly and westerly on the southern side of the island. It forms a long and curved ridge resembling an irregular wall; which, generally speaking, may be considered as flat at the top, and perpendicular at the sides. This is almost strictly true at the eastern extremity, the part where its chief grandeur is displayed; but towards the west it gradually becomes irregular in every respect; terminating ultimately in some detached and independent masses. Although it occupies the summit of a long and sharp ridge of hill, it is placed more on one side of the declivity than the other, in consequence of which its perpendicular altitude is much greater on the southern than on the northern face. The mural aspect of the latter face disappears indeed entirely towards the west, while on the southern the disjointed portions still preserve a degree of that character to the very end. As far as I could compute its length by pacing, it appeared about a mile and a quarter long, the direction being from S. W. to N. E. The breadth of this ridge varies with its regularity, but at the eastern extremity, where the sides are most parallel and the regularity greatest, it does not seem to exceed 100 yards; towards the western extremity it is considerably less. The height, as measured by the plumb line, was 470 feet; but the obliquity of the base renders it impossible to give a just conception of the nature of that measurement, without the assistance of a diagram showing the mode adopted.*

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* Scuir, a rock. Hence the English Scar and Scaur; also skir, skerries, with the compounds Hysker, Dusker, Talisker, common names among the islands. See Plate V.

Nearly the whole of this rock is formed of columnar beds, which vary considerably in different parts, both in their size and disposition: they are most regular toward the eastern end. Here the columnar forms are either vertical, or at least placed in an upright direction, with the exception of one oblique bed visible at the very extremity. In proceeding to the west, both the arrangement of the beds and the directions of the columns vary; the latter being in many places inclined, horizontal, or disposed in curvilinear directions; while, in some parts, even the columnar form disappears. At the eastern extremity five distinct beds are to be traced. The three lowest of these are columnar and formed of the porphyritic rock about to be described; the fourth is of common trap, and the fifth and uppermost resembles the lowest. Toward the western end however there are three trap beds interposed among the others, the point at which the change takes place not being easily determined. They are readily distinguished by their non-columnar aspect, as well as by their tendency to decomposition; in consequence of which they form deep furrows in the face of the rock. They are of a grey colour, with a texture intermediate between basalt and greenstone, and occasionally porphyritic; being each about twenty feet in breadth. The pillars of the columnar beds are by no means distinct, and, from the smallness of their size, can scarcely at a little distance be perceived, although they still communicate their general effect to the whole. They rarely attain the diameter of two feet, and more frequently do not exceed one; while, in the western and detached parts of the ridge, they are found even of three or four inches in diameter. They are occasionally regular, although varying in the usual manner in the numbers of their angles, but are never jointed. On the contrary, the course of each column must be considered as short and independent, and they generally therefore terminate at both ends in a thinner and prolonged shape, as if they had been packed together in a parallel although irregular manner while in a soft state, and thus suffered to compress each other. From this cause they are often very irregular in form; being sometimes doubled, or even occasionally cemented in greater numbers into a common mass, so that the columnar shape entirely disappears. They are in no case as easily separated from each other as basaltic columns are; whence, along the southern declivity, immense fragments of the rock are to be seen which have fallen from the summit and rolled for a mile or more, even to the sea shore, without losing their integrity. The top of the rock being formed of the ends of these columns resembles a very irregular pavement, and under the lowermost bed are seen some excavations beneath the overhanging rock, formed by the wearing of the softer substances on which the whole rests.

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* The diagram represents the end view, and the point assumed for measurement is that where the absolute perpendicular altitude is greatest. It will readily be perceived at the same time that the real altitude is more considerable, since it lies between the two horizontal lines A C. Adding for the space A B 120 feet, the total height is 470 feet, that of the portion actually plumbed B C being 350. See Plate XXIII. fig. 6.

The rock thus described is a pitchstone porphyry, and is a substance of great beauty, the base being intensely black, and the crystals consisting of glassy felspar thinly disseminated. It is less brittle than the generality of pitchstones, acquiring a harsh brown surface on weathering; and might perhaps with more propriety be considered as intermediate between pitchstone and basalt. It contains no imbedded minerals; those zeolites and chalcedonies which are found dispersed near the Scuir being derived from the trap rocks associated with it. The nodules of chalcedony are the most abundant, and among these I procured a specimen of that onyx so deservedly in esteem among sculptors for works in cameo. The laminæ are parallel and of the most decided opposition, the one being brown the other white, with the line of separation between the colours decidedly marked.

In a slight notice on this island in the second volume of the Geological Transactions, I mentioned that this rock rested on a marle, and that again on a sandstone. This is an error which the further clearing away of the soil since that time enables me to correct. The "marle" is a mixture of limestone, clay, and sand, containing nodules and veins of rude quartz, but there is reason to suspect that it is a large nodule entangled between the porphyry and the subjacent mass, or else belonging to the latter, and not a continuous bed. This mass is a conglomerate consisting of small and large fragments of red sandstone, trap, and silicified wood, imbedded in a basis of trap; a substance already described as occurring in the island of Canna. In other places the Scuir may be clearly seen resting on the same trap with which it alternates, and thus forming, as I before remarked, the uppermost rock of this interesting island.

MUCK.*

This little verdant island forms part of a group with Rum, Canna, and Egg; resembling in some measure the two latter in composition, and presenting one common feature with the last, namely, the upper members of the secondary strata, subjacent to the trap which constitutes the principal part of its mass.

From this rock it derives the same excellent soil which distinguishes Canna, with the same fertility, and the same perennial verdure. Its surface is undulated throughout, and presents in every part the rocky faces of the basaltic terraces that constitute these irregularities. It possesses but one decided hill, situated near the western extremity of the island and attaining an elevation of about 600 feet. The shores are in general low and rocky, but near the western end they rise into cliffs of about fifty or sixty feet in height. The length of Muck is about two miles and the breadth less than one; a space too small for the collection of water sufficient to form even a brook; but it contains springs as do all the islands which consist of the same rock.

From its structure it is deficient in peat, a want severely felt by the inhabitants, who are thus compelled to procure this article from Airdnamurchan.

Basalt and fine greenstone are the predominant varieties of trap here found. These have sometimes an indistinct columnar tendency; more commonly they are amorphous. The rock is now and then pure, and at other times, without being properly amygdaloidal, it contains analcime and mesotype imbedded in small dispersed nodules. In some places a stratum of true amygdaloid of a loose texture is seen under the simpler trap, but I observed nothing sufficiently different from that which has already occurred on the subject of the trap rocks, to render more particular details on this part of the geology of Muck necessary.

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* Muc, a hog; Gaelic. See the Map.

The only exception to the universality of trap in this island is to be found at the bay of Camusmore, the only spot which is interesting in a geological view. A series of stratified rocks here comes to the surface, of which however but a very small portion is accessible, as the strata do not reach to many feet in thickness above the low-water mark.* They have but a trifling inclination, dipping towards the north in an angle not appearing to exceed five degrees. They consist of different beds of sandstone and limestone, of which the former are the lowermost and the greatest in quantity. These are generally of a calcareous quality, and are white, very much resembling the sandstone which occurs in a similar situation in Egg. The limestone verges from blackish blue to pale grey and dove colour, becoming nearly white on the surface by the action of the sea. Some of the beds contain the remains of shells not easily ascertained; in others the rock is of a moderately fine granular texture; while in a third set it has a flat conchoidal fracture, with the smooth surface and brittleness of glass.

These beds are traversed by sundry veins of trap of different aspects and compositions, undergoing at the same time great disturbance. The trap is sometimes porphyritic, at others it has the aspect of an ordinary dark blue basalt, and in one or two instances the vein which is dark blue and hard in the middle, becomes of a very pale smoke blue at the edges, acquiring in those parts considerable softness. The limestone, which is of a coarse grain at a distance from the trap, often assumes a fine one with great brittleness in its vicinity; while in other cases it undergoes no change; as if disproving in the one place that influence of the trap, which in another it appears to confirm.

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* Plate XXXII. fig. 2.

But if the chemical or mineralogical variations of the limestone prove nothing with regard to this influence, it is not so with the mechanical derangements. Where the veins are most numerous, the limestone is broken into pieces and entangled in them, while the directions of the strata are at the same time reversed; from horizontal becoming perpendicular. Solitary fragments of a few inches in diameter are also found insulated in the basalt. These disturbances are not much unlike those which in Glen Tilt take place at the junction of the granite with the stratified rocks, and still more resemble others which will hereafter be pointed out in Seil and in Bute.

Among the trap veins I observed a substance forming what seemed to be a disturbed portion of a bed. It is a sort of chert exceedingly brittle and sharp in the fragments, very much resembling that which is involved in the pitchstone vein of Egg. It will be recollected that the same rock occurs among the limestone on the east side of Sky, and that it was there proved to depend on the influence of the surrounding trap, while the accompanying shale was in the same circumstances converted into siliceous schist. There can be little doubt that the portion of chert here described has also been a fragment of one of the calcareous beds, owing its present induration to the same cause as its position, namely, the intrusion of the trap vein.

On reviewing this insulated portion of secondary strata there can be no hesitation in referring it to the same formation as those of Egg, namely, the lias series. Although it presents no organic remains capable of establishing this identity, the general appearance of the beds is almost sufficient to prove this correspondence. If to that be added the absolute resemblance of the several substances to those which occur in that series in different parts of these islands it will appear evident that like the uppermost strata of Sky, Egg, Mull, the Shiant isles, and the neighbouring shores of Morven, the strata of Muck are part of a series of which the remainder has disappeared in the revolutions of this part of the earth's surface; overwhelmed by the incumbent rocks, or perhaps still existing in a dispersed manner under the depths of the sea.

INCH KENNETH.*

The value of Inch Kenneth in examining the neighbouring shores of Mull will be apparent when the construction of both has been described. Independently of this merit to the mere geologist, it has a claim on the notice of every one who visits this country, since that which Johnson has described is esteemed classical ground by the tourist. The ruins of Sir Allan Maclean's house, with the chapel, the cross, and the tombs, are still to be seen; the decayed walls of the chapel reminding us, (to borrow a sentiment from that author) of the superstition of those by whom these structures were erected, and of the piety which has suffered them to become the habitation of the nettle and the toad: the cemetery unenclosed, unprotected and forgotten, the haunt of the plover and the curlew.†

This island is elevated towards the north-west into high overhanging cliffs, rising to the height of an hundred feet and upwards. On the opposite quarter it becomes gradually lower till it meets the sea, but is bounded on all sides by exposed rocks which render its structure very accessible. The prolongations of these form ledges which extend far to sea around it in almost every direction, and render its navigation difficult, or, to those unacquainted with the coast, even perilous. The rocks are almost entirely of secondary formation, and consist of sandstone and conglomerate. The strata are variable in colour, being lead-blue, white, or red, or variously mottled with all these hues, while even the same stratum, blue in one place, may be red or white in the next. This rock is sometimes mixed with much calcareous matter, at others it is simply quartzose. In general the strata of fine sandstone are uppermost, but this is by no means an invariable rule, as they will be sometimes found alternating with the conglomerate; and it even happens, as in other places, that a single portion of any given bed may be found consisting of a coarse conglomerate, while the remainder is a fine sandstone. The beds of conglomerate, where most accessible to observation, constitute a mass apparently of about 100 feet in thickness. Their basis consists of a mixture of coarse and fine sand, and the imbedded fragments are either sharp or very little rounded, being formed of small and large pieces chiefly of quartz and quartz rock.

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* See the Map of Mull.

† The apparently groundless impression made in Scotland by Dr. Johnson's work still remains in full force. It is amusing to listen to the acrimony with which he is spoken of, and by many who assuredly have never read his book. In his account of the islands he has passed over with a suavity and humanity little to be expected, circumstances in the condition of the country and of the inhabitants which, under a state of far greater improvement, recent travellers are little inclined to treat with the same lenity. It is probable that he had expected to see a life purely savage, and had thus given the islanders more than due credit for the few comforts they possessed. Sterne's noted character would not have described the same tour with the same good humour, even in the present day.

In most places this rock is the lowest visible one, reaching far beneath the spring tide low water mark. But in two or three points on the western side the basis on which it rests can be seen, especially at low water, the period which a geologist should always choose for examinations of this kind. The sandstone and conglomerate are inclined at a low angle, rarely reaching ten degrees, and dip to the N. N. W. The rock on which they rest lies, on the contrary, at an angle of forty or forty-five degrees, and its dip is about S. S. E. The plane of the former set of beds is therefore placed on the edges of the latter, or it lies in the position which has been called unconformable. The lower rock consists apparently of quartz rock of an exceedingly compact texture, and of a purplish and blueish hue. From those two circumstances of position and structure, it must be concluded that these strata belong to the primary class; but as they occur in Mull, occupying a much greater space and in a more accessible manner, I shall defer the further consideration of their connexions until I can prove that they form a part of the great mass of gneiss which predominates on the adjoining mainland.

MULL.*

THIS island, the third in magnitude of the Western isles, although possessing but little attraction either for the general traveller or the lover of natural beauty, is far from being deficient in interest to the geologist. It presents some striking examples of those junctions and relative positions of rocks which have recently been objects of attention, and have thrown so much light on the science of geology. In other respects it exhibits a great sameness of structure, from the predominance of one set of rocks, those of the trap family; and is therefore less calculated for the amusement than the instruction of the geologist; to whom moreover its wet and stormy climate, its trackless surface, and boisterous shores, present a perpetual succession of the most discouraging obstacles. He who shall pursue step by step the connexions of the rocks of Mull, may be assured that he possesses at least one of the fundamental requisites of a practical geologist.

Mull is of a very irregular form, being deeply indented in one part by Loch na Keal, and projecting toward the south-west into a long promontory called the Ross. Its extreme length, which is at the southern side, is about thirty miles, and its next most considerable dimension from south-east to north-west is about twenty-five. The surface, as well as the shore, is so irregular, and in different parts so dissimilar, that it will conduce much to perspicuity, bôth in the geographic and the geological description, to divide it into certain physical portions. These are partly regulated by the general aspect of the surface, and partly by the nature of the rocks; the latter, in many cases, producing considerable differences in the characters of the several divisions. Those adopted are the following: the primary, the southern trap, the middle trap, the northern trap, and the mountain districts.

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* Mull, Meule, also Meal. Moel in Welch. A mass of hill. Moles? See the Map.

The first occupies the western end of Ross, and is bounded by an irregular line drawn from near Bunessan to Shiha; while the second, or southern trap division, which is continuous with it, extends from this line to Duart castle. The middle trap district occupies the promontory of Gribon as far as the foot of Ben more, where the mountainous division commences, extending to the opposite coast and bounded on one side by the kirk of Torosay or the castle of Aros, and, on the other, terminating between Macalister's bay and the head of Loch Don. The remainder of the island northward of a line drawn from Aros to the head of Loch na Keal, constitutes the northern trap division.

Commencing with this last division, the whole surface is hilly and irregular, yet, although high, cannot be called mountainous. It presents every where that aspect so characteristic of trap countries, in the terraced forms rising by numerous stages from the shores to the highest elevation, which seems never to exceed 1200 or 1500 feet. The shores are various in their appearance. Sometimes they present cliffs, at others the rocky terraces or the grassy slopes descend to the water's edge. Small sandy beaches are seen in one or two deep bays, and as is the general case in the Western islands, they are formed of broken shells. It is but rarely that any picturesque features are found along the shores, and in the interior of the country they never occur. A few of the promontories and columnar ranges on the shores of Loch na Keal and in the sound of Ulva, present solitary studies which are not deficient in interest to an artist; being either clothed with ivy or decorated by the scattered remains of oak and ash coppices. In the same places the basaltic veins sometimes also present objects often more singular than picturesque; remaining like ruined walls of castles rising high above the surface, while the surrounding parts have decayed; and scarcely distinguishable from them at a small distance unless by the experienced eye of a mineralogist. The division which I have now described contains the districts of Mornish, Mishnish, and Quinish.*

The middle trap division, which includes Gribon and part of Torosay, differs but little from the former in its general aspect, as it also consists for the greater part of the same trap terraces disposed in a similarly scalar manner; but ascending to a much greater height, since the highest land of Gribon has an almost uniform elevation, apparently not much less than 2000 feet. The western side is here bounded by high cliffs with steep slopes, attaining an elevation of at least 1000 feet; and the southern descends by interrupted slopes to the even and level shores of Loch Scredon.

It is in this part of the island that the caves which form objects of attraction to a numerous class of visitors are found. One of these, known by the name of Mackinnon's cave, is of considerable magnitude. Tradition still points out the table on which the feast was served, and the uses of several other parts: uses sufficiently probable, since it is undoubted that similar retreats were occupied either as the temporary abodes of predatory partisans, or for the concealment of the feeble and the property of the clan during the incursions of an enemy. Although dark, lofty, and profound, and from these circumstances imposing to the imagination, it offers no forms for the painter; nothing but an abyss of vacancy in which the eye seeks in vain to repose even for a moment on the evanescent objects around. It appears to be one of the discontinuities formed by a vein of trap which has afterwards been washed out; this being the most common origin of those caves which are found in the Western islands. At a little distance from this, is to be seen an open and arched, but shallow excavation, of great size, formed in the secondary strata; through the roof of which numerous small streams of water perpetually distil, generating huge but rude deposits of calcareous matter in stalactitic forms. Ash trees and ivy mantle over the roof and creep along the walls, producing with the sublime back ground of the cliffs which tower high and distant above it, a scene of great effect and admirable colouring.

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* Nish, Ness, a point or promontory, a common termination in the islands: thus Trotternish, Vaternish, Minginish, in Sky.

Among the infinite varieties of difficult ground which it is the fate of the investigator of these regions to traverse, there are few more unexpectedly laborious and tantalizing than the shores in the neighbourhood of these caves. The strata are of various degrees of thickness from one foot to four and upwards, while they all lie at angles varying from thirty to fifty degrees or more, their broken edges being cut abruptly off at right angles to the stratification. Thus they resemble an irregular and huge staircase which has been inclined, the surfaces looking to the land while the outer edges are necessarily turned at a considerable angle upwards. In traversing them therefore, for the purpose of landing, if a step is with some difficulty surmounted, it is only perhaps to conduct the pedestrian to a much lower point than that which he last ascended; and it is not till after crossing an infinitude of these alternate elevations and descents, that he finds himself on the land at a height but little above that from which he commenced; notwithstanding the great perpendicular space through which he may have passed in crossing this kind of double staircase.

At the eastern end of this division rises the group of high hills that forms the mountainous tract and the district of Torosay; visible, from its great elevation, afar throughout all the western shores of Scotland, and the fertile parent of the rains and storms which seem to have erected their throne in this cloudy and dreary region. Ben mo the highest of this group, towering above all the rest with almost the same superiority that Ben Nevis rises above the general levels of the hills which surround it. The height of Ben more, as I found it by the barometer, is 3097 feet,* while that of Ben y chat, the highest hill next to it, is only 2294: and this latter may without much error be assumed as the average elevation of the remainder of the mountainous division. This division gradually subsides on the north and east into the low land near Aros and into the flat shores which skirt the sound of Mull from that place to Duart; while to the south it descends to the sloping shores of Loch Scredon, or is blended with the range of uniformly high land that constitutes the southern trap division.

The outline of this portion is strongly marked in one part by the high cliffs which extend from Inimore to Loch Buy, while to the eastward of that bay it declines into the flat shores and indented outline of Loch Speliv and Loch Don. At the western extremity it blends with the primary division, which, with a strongly indented and rocky outline, is either disposed in small and numerous rugged eminences through which the naked rock is every where seen projecting, or presents the more undulating features that attend the schistose varieties of gneiss.

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* On this mountain I was accidentally led to observe the degree of cold produced by the mixture of ice and alcohol. A storm of hail had fallen, accompanied by a temperature below freezing. Some whiskey, the usual appendage of a Highland viaticum, being produced, I was obliged to dilute it by putting some hail into the cup. In an instant the metal was covered with ice and frozen to the grass: on trial, the quicksilver of the thermometer sank into the bulb. On repeating this experiment afterwards with common alcohol, the cold was found to amount to forty-nine or fifty degrees. It presents a convenient method of obtaining a low temperature when other less common materials are not at hand.

UNINTERESTING and inconspicuous as are in general the antiquities which occur in the islands hitherto described, those to be seen in Mull are still more rare and less deserving of notice. The enumeration of cairns, barrows, or grave stones is indeed fruitless, and scarcely capable of furnishing amusement even to the mere antiquary; nor does any monument of this nature seem here to exist, worthy of investigation or record. The castle of Aros, however, if it can be considered an antiquity, is interesting, from the picturesque object which it affords to the artist; the more so as the country is so devoid of scenes on which his pencil can be exerted. Still more striking, from its greater magnitude and elevated position, is Duart castle, once the strong hold of the Macleans, and till lately garrisoned by a detachment from Fort William. It is fast falling into ruin since it was abandoned as a barrack. When a few years shall have passed, the almost roofless tenant will surrender his spacious apartments to the bat and the owl, and seek shelter like his neighbours in the thatched hovel which rises near him. But the walls, of formidable thickness, may long bid defiance even to the storms of this region; remaining to mark to future times the barbarous splendour of the ancient Highland chieftains, and, with the opposite fortress of Ardtorinish, serving to throw a gleam of historical interest over the passage of the sound of Mull. The castle of Moy, situated in Loch Buy, is one of the most entire of these more recent antiquities. Standing near the modern excellent mansion it presents an interesting contrast; strikingly illustrating by this relic of former habits, some of the most important results of the change from ancient poverty and consequence to modern wealth and insignificance. The Highland chieftain who still regrets the loss of his former power and influence, would willingly possess his new acquisitions also: would willingly govern yet claim the protection of the state;

and forgets that he cannot combine the elegancies and comforts of modern life, with a dark and disturbed residence in a rude and narrow tower.

Tobermory (St. Mary's well) has no longer a chapel to mark the site of its healing spring; which has disappeared, like the Florida that lies off the shore buried with many more of the Invincible Armada, deep beneath the waves.* But Tobermory, if it offers nothing to

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* With respect to the Florida I find on record a very important chemical fact, which, ten years ago, I had imagined to be my own discovery. The Highlanders who anticipated me, have still longer anticipated others who have recently noticed this circumstance in the public journals.

In 1740 Sir Archibald Grant and Captain Roe attempted, with the assistance of divers, to weigh that ship. The attempt was unsuccessful, but guns both of brass and of iron were brought up. The former had the mark of an English founder, R. and J. Phillips 1584, with a crown and E. R. The iron guns were deeply corroded, and on scraping them became so hot that they could not be touched; but they lost that property after two or three hours exposure to the air.

I observed the same circumstance, first, in some iron work that had long been immersed in the porter backs of a London brewery, and then confirmed it by some direct experiments. It has since been remarked in the waste pipes of a brewery at Plymouth Dock and under other analogous circumstances, and the experiments have been repeated by other chemists. The matter thus remaining after the solution of the iron is plumbago, in no respect distinguishable from that substance in its ordinary mineral state. There is nothing unexpected in this result, since carbon is known to be a constituent of cast iron. To ascertain the state in which it exists in the iron is however a matter of more importance and of more difficulty; nor does our knowledge at present afford any means of determining it by direct analysis. The eye does not discover any difference between the substance in question before and after this sort of combustion, for which the presence of oxygen is, as in other cases requisite. There is however little doubt that it is analogous to the combustion of the inflammable metals, or of the alkaline bases. It is equally probable that a portion of the change is effected during the solution of the iron. In some cases indeed the plumbago is completely formed, the antiquary, is interesting to the political economist, since it presents the germ of a town destined probably to remain for some time a warning proof, if fond experimenters in this science could take warning, of the difficulty of counteracting the habits of a people, or of hastening by forced means the natural progress of a country in arts and commerce. This town was commenced in 1789 under the auspices of the Society for the Encouragement of Fisheries, but it has remained nearly stationary since its first establishment. The causes of this have been sought in the grant of unimproved land which was attached to each house, the whole being given to the settler at an extremely low price. Hence the idle rather than the industrious flocked to occupy the new settlement, while the want of industry and ambition too characteristic of the Highlanders, combined with their agricultural habits, made them bestow on the improvement of their lots of land the little labour they were inclined to exert; neglecting the fisheries and manufactures which were the objects in the contemplation of the Society. But the premature nature of the speculation was the leading error, since if a town was to be created at any rate, it must be admitted that without such grants of land no houses

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and no combustion takes place on pouring off the fluid. Although the metal of plumbago has not been produced, there is no reason to doubt that in this case it is that substance which is combined with the iron, and that the produce under consideration is a compound; an oxyde or something analogous to that. This is indeed rendered certain from a comparison of the specific gravities of the two. That of pig iron is about 7,6 and that of plumbago about 2,0 or less; while the bulk of solid plumbago produced is equal to that of the iron exposed to solution. It is plain that it must be combined in some state in which its sp. gr. is not far different from that of iron, and that it must therefore be a metal. I may add that artificial solid black-lead can be thus produced; but it is doubtful if it could be effected on such terms as to render it an object of economy.

could have been occupied nor any settlement made; as there was no employment ready, on the profits or wages of which the settlers could have existed. As a fishing station it is unfavourably situated, since the uncertainty of the herring shoals, and their protracted desertion of this part of the coast, prevent the adoption of that variety of the herring fishery which is carried on in small boats; the only one within the power of little proprietors, and which, in the best of events is, from its transitory nature and uncertain produce, an insufficient employment. It is equally unfavourable for the cod or ling fishery, since no banks or grounds for this description of fish occur in the neighbourhood, and it cannot be pursued at any considerable distance from home in the small and insufficient boats which alone are within the reach of these poor people.

The impossibility of forcing manufactures seems equally evident, although economists appear too often to have imagined that the power of collecting a mass of people together, was the only thing requisite for their establishment; or that, like the plants which vegetate by the brook, they must necessarily spring up wherever that brook was capable of turning a mill. Capital does not readily seek for new outlets till it is dammed up to bursting, and many circumstances yet wanting must coincide, before a paper mill or a carding engine can be erected under the waterfalls of Tobermory. As far as respects those manufactures required for the ordinary consumption of an agricultural district, and which form a principal cement of the smaller towns throughout the country, the habits of the Highlands are not yet ready to receive them. With little superfluity to spend in objects of luxury or ornament, or even in the more perfect kinds of those utensils which are indispensable, and with long established habits of submitting to the use of imperfect substitutes, their want of employment for a great portion of the year necessarily leads them to construct for themselves those things for which a richer and a more fully employed population has recourse to the industry of towns; promoting that division of labour which is mutually profitable, but which must be the gradual result of circumstances, and cannot be forced.*

WITH the exception of the small rocky portion which occurs at the Ross, and that of a few of the summits in the mountainous tract, the soil of Mull is both deep and fertile, being considerably more productive of pasture in a given space than that of Sky, which in other circumstances this island so much resembles. This arises from the greater extent of trap rocks it possesses; all of which moreover seem to be of such a constitution as on mouldering to fall readily into a good soil. The uncommon moisture and ready drainage of the country are also conducive to that verdure which here occupies tracts that in flatter and worse drained countries are covered with useless bog and heath. Even Ben more is clothed with luxuriant grass nearly to its summit, wherever the declivities are not so steep as to occasion it to be suffocated by the incessant fall of rubbish and stones. This island has in former days been celebrated for its woods, but the woods of Mull, like those of the islands in general, have long since vanished; although the remains of oak, found in a few neglected coppices intermixed with birch and hazel, show that care and attention, if care and attention to this object were either fashionable or profitable, might again restore these woods to a respectable appearance. Yet oak can scarcely succeed in these islands in any situation as an object of profit, except as coppice; since even where there is shelter, either the shallowness of the soil on the declivities, or the boggy nature of the low lands, are inimical to its rapid growth. Ornament may be readily procured from birch and from alder, which flourish in most similar situations; but where the process of enclosing must be the expensive forerunner of such operations in a country highly stocked with cattle, it is too much to expect that planting for mere ornament will be attempted, where so few proprietors have a permanent or a favourite residence. Larch, fir, and other woods have indeed been recently planted in the northern parts of the island, and where a peninsular situation or other favourable geographical circumstances render enclosure cheap, there is no question but that ultimate profit as well as contingent ornament will result from these undertakings. Yet I must remark that the two former trees seem less adapted to the insular situations than almost any others; nearly the whole genus, as far as it has yet been tried in similar soils and exposures, being checked after a very few years growth, and ultimately destroyed. The planes, noted for their indifference to the effect of winds, seem unfortunately to be nearly unknown throughout the whole country. The preservation however of even alder and birch, is an object of rural economy too much neglected here as elsewhere; since the utility of both for cask staves, and of the latter for all the usual architectural purposes of the country, stamp a considerable value on them The transportation of birch from Airdnamurchan and other shores where it abounds, to the naked isles of Tirey and Iona, and to the whole chain of the Long isle, at a considerable expense of labour or freight in addition to the first cost, are sufficient evidences of the demand for this raw material, and of its value. In the present circumstances, Mull still exports these woods to the neighbouring isles; and while every thing connected with rural economy is gradually though slowly improving throughout this country, it is scarcely to be doubted that it will one day recover in this respect a portion at least of its former fame. On the eastern side of the island, in sheltered situations, the ash grows with great vigour and beauty; and to him who has for months traversed naked and dreary heaths, varied only by rocks and torrents, and experienced the feeling of desolation and solitude which a country without wood never fails to produce, the trees which surround the house of Scallasdale present a freshness, a luxuriancy, and an aspect of summer, reminding him of that which the more distant traveller must experience when some verdant spot meets him in the passage of the desert. The ash is indeed the tree of most value among those congenial to this climate; yet it has been neglected even in the recent improvements, where we might have expected to find it one of the first objects of attention.

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* Although many of those wants for which the country must always depend on the industry of towns are still but ill supplied in the Highlands, the establishment of shops has materially tended to increase the comforts of the inhabitants and, by presenting new wants, to stimulate their industry. Dr. Johnson could not now remark that if a female should break her needle in Sky her work must stand still. The activity of commerce has in this way insinuated its objects almost every where, to the evident advantage of all parties. It was not unamusing to observe a printed bill of "Turner's liquid blacking" on the walls of a cottage in one of the most remote districts, where, till lately, even a shoe was unknown.

Although the soil which lies on the granite and gneiss in the Ross of Mull is, as I have already remarked, less rich and less deep than that of the trap districts, yet it is in a given extent more productive of corn. But this fertility arises from adventitious causes; from the more perfect exposure to the sun which this comparatively flat tract presents, and its exemption from the early or late shadows of the mountains which intercept the light in the tracts that lie in their vicinity. The gravelly nature and consequent porosity of this soil is also better suited to the excessive moisture of the climate, than the constitution of the trap soils; in which the excess of retentive power, while it causes these lands to be clothed with perpetual verdure, is unfavourable to the due growth and ripening of corn.

It may be said in general that Mull is among the islands least adapted for the cultivation of grain, and its population, estimated at 10,000, of which the chief agricultural occupation consists in grazing, is consequently compelled to exchange the cattle in which it abounds, and of which it consumes but little, for imported corn. The absence of commercial habits, and the want of a steady and well regulated demand for that commodity, produce at times considerable inconveniencies, as might be expected; since the supply cannot always be procured at the moment the demand occurs; and these accidents, unavoidable in such a state of things, have here as elsewhere produced the usual clamour, even among those whose superior education should have taught them where the real cause of the evil lay.

Since the climate of Mull is principally adapted for grazing, the opulent and enlightened proprietors and tenants who reside there, have lately turned their attention to this object, with the usual result of an essential augmentation in the quantity, and an amelioration in the quality, of their stock. The number, both of black cattle and sheep, has been increased, and the breed of the former materially improved. The Tweedale breed of sheep has been universally substituted for the ancient Highland one, which is now rarely to be met with except in St. Kilda and the other remote isles. A few of the Cheviot race are also to be found in the low farms, but their supposed delicacy has hitherto prevented their extensive adoption in a climate so boisterous. The introduction of green crops, an improvement so little known in the islands, has been commenced; and time, which makes the philosophy of one age the prejudice of the succeeding, will at some future period establish that as a system which is now considered as an innovation.

The horses of Mull have been long noted for hardiness, but the breed has been lately much thinned in consequence of the allotment of farms, the improvements in farming, and the alterations in the value of land which have already been noticed on different occasions. Whether from a continued and progressive diminution of the number of horses required in farming, or that from ancient careless habits respecting the management, the supply is still greater than the home demand, this island, like Sky, now exports a few to the Irish market; the purchasers coming for them towards the end of summer in crazy boats apparently but ill fitted for such a voyage.

Mull, from the nature and disposition of its rocks, as well as from the exposure of a great tract of its shores to the boisterous action of the western sea, is not very productive of kelp, but about 600 tons are supposed to be manufactured annually. On this subject I have already said all that can be interesting in a popular view, and I need only add, that the quantity of labour employed here by this manufacture, bears but a small proportion to that which this island might furnish, with advantage both to the wants and to the habits of the community.

Of whatever immediate or ultimate improvement Mull may be susceptible, little is to be expected until a freer communication than exists at present, has been effected by means of new roads. In this first of all agricultural improvements it is lamentably deficient, scarcely a mile throughout the whole island being passable for a wheel carriage, if we except the short line from Achnacraig to Aros. The assistance formerly held out by the commissioners, and lately recalled after ample time had been allowed to the proprietors of Highland estates to profit by it, has been unaccountably neglected: but it is not the business of a passing traveller to spy the nakedness and record the provincial politics of those lands which, with views far different from these, he has been led to visit.

I HAVE already hinted at the extraordinary wetness of this climate. Mull may indeed be said to be the most subject to rain of all the islands; exceeding in that respect either Rum or Sky, which hold the next rank to it. The cause of this is probably to be found, as well in the altitude of its own hills, as in that of the range which extends from Cruachan to Ben Nevis and assists in precipitating the clouds that arrive from the western sea. But it must also be remembered, that it is, with the exception of the southern part of the Lewis and Harris, the only land of high mountains immediately open to that sea. Sky, equally mountainous, is to a certain degree covered by the range of the Long isle; the mountains of Harris precipitating much of the water, and diminishing the violence of many of the storms, which would otherwise reach it. These fall with undiminished energy on Mull, in gales of wind and rain of which the inhabitant of the more favoured climates of Britain can form no conception.

During the investigation of this island I had an opportunity of observing a barometric phenomenon, which is important as a question of natural history, and is also, on account of the practical results which flow from it, interesting to the mariners who navigate these narrow and tempestuous seas. While in the sound of Mull, I was overtaken by a gale of extreme severity, which blew the whole night and part of the succeeding day. Previous to it the barometer had for some time remained steady at about thirty inches; and, neither immediately before, nor during its continuance, did the quicksilver subside or experience any oscillation. I must add, that for six weeks of the same season in which this observation was made, similar gales of wind and rain had raged along the coast, and that in but two or three instances was any material depression or change in the barometer found to take place; its altitude remaining tolerably steady for the whole period, or at least undergoing no changes corresponding to the occurrence of the gales. On one of the occasions which I have excepted, it was afterwards known that the same gale, which I experienced with great severity in the island of Egg, had been of great extent, since in that storm the loss and dispersion of the Jamaica fleet in 1815 took place. It is equally probable that in the other cases where the barometer was affected, the gale had also occupied a wide range, although not so remarkable as to be recorded, like the former, in the public prints. On that occasion my barometer fell half an inch in the space of four hours, although the gale in itself was neither more severe nor of longer duration than many which had occurred through that long period of tempestuous weather. That most of these gales were local, or extended through a small space only, was confirmed when I afterwards arrived on the east side of Scotland, where the whole period had been characterized by continued fine weather and an uncommon drought; whereas on thewestern coast scarcely one day in five was free from torrents of rain.[*] It is perhaps scarcely necessary to say that these observations were confirmed by corresponding remarks made on too distant stationary barometers, since it is now well known that a general agreement is found to exist between these, within certain limits as to distance in position.

It follows therefore that the barometer is not affected by local atmospheric changes, although these are considerable; neither sinking to denote rain or wind, nor rising to indicate fair weather, except in those cases where the changes depend on causes of a very extensive nature.

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[*] I may add that this observation has been confirmed on innumerable other occasions; some of the instances having been even much more remarkable. In one storm, which occurred in Sutherland, the barometer gradually rose an inch in twenty-four hours, namely, from 29,2 to 30,2 during its continuance, and subsided to the same level after it had ended. Neither did the effect result from change of wind, as the gale was from the west, and the wind, which had previously been from the eastward, returned to that quarter after its termination. This fact presents a remarkable example of a double anomaly.

In a practical view we are thus enabled to explain a phenomenon of frequent occurrence, particularly in summer; namely, the inutility of the barometer on certain occasions in pointing out either future or actual changes from calm to storm or from fair to foul weather. Nothing is more usual than for the mercury to maintain a steady elevation for considerable periods during our summer, if the wind undergoes no change of direction; although rain is predominant or alternates with fair weather. These changes of weather are thus shown to be partial; and of this we have generally sufficient evidence in the current reports from different districts. The inutility of this instrument as an universal indicator of weather is thus proved, if proof of a fact so notorious were necessary; but the cause is also pointed out, since it is here seen that no changes of weather will affect it unless they are of a general nature. It is for this reason that in autumn, as it approaches towards winter, and throughout this season as far as the vernal equinox and beyond, the barometer becomes a more accurate, often a very perfect register of these changes; which would thus be proved, even if that were not confirmed by collateral evidence, to be of a wide extent. The next practical result to be drawn from this fact is of still greater importance, and would be even more so, had the marine barometer become an universal appendage to the instruments used in navigation. In the instances above related, not one gale of wind out of ten would have been indicated by it; and the mariner who, depending on its warnings, should therefore neglect, in sea language, to keep a good look-out, would endanger the loss of his vessel by trusting to a fallacious guide. The use of this instrument has hitherto been so limited, and I may add the observations, even if carefully made, so inaccessible, that I cannot, in the writings of those navigators who have used it, refer to any proofs of this uncertainty.

While on this subject I must mention some facts which have occurred to me on comparing the movements of distant barometers; having been led to observe them from attempting to ascertain altitudes by referring, as a standard, to a fixed instrument. They are interesting, both as they relate to the history of the atmosphere and to that of the instrument. They are not less so in a practical view; as they inculcate the necessity of precaution in estimating altitudes by the barometer when the horizontal distance between the upper and lower station is considerable; as well as that of great care in the construction or choice of the instrument itself.

It is well known that the oscillations of the mercurial column become greater progressively as we increase our latitude; but that, with this difference, there is a general conformity in them in different latitudes: in Europe at least. But it has also appeared, in comparing the observations above alluded to, that at different stations, and independently of change of latitude, or of the effects arising from it, the variations of any two or more barometers are not always the same in quantity, and do not occur at the same time: they are neither equal nor simultaneous. With the intention of verifying the nature and extent of these inequalities, various registers were compared; all the instruments being of the best construction, and the observers of unquestionable accuracy. For the purpose of estimating certain errors arising from imperfect construction, hereafter to be mentioned, a parallel set of experiments were conducted with a number of barometers in one place; some of them being purposely made in different ways imperfect. No other mode of estimating errors from this cause is possible; since, had any of the barometers at the distant stations been approximated and compared, it might still be suspected that they had undergone some change after separation. I think it proper however to remark, that, among these comparative experiments, different attempts were made to derange the instrument by subjecting it to many thousand inversions, as being that motion to which it is subjected by use; but without effect.

I shall now enumerate a few of the most remarkable differences observed on distant barometers.

Between London and Greenwich* the differences were found to vary from 0 to 0,1, 0,2, 0,25, 0,28, in quantity; while the times of the greatest elevation or depression also occasionally varied from twelve to twenty-four hours; the one barometer sometimes reaching the lowest or highest point first, and sometimes the other. Similar differences, but less in quantity, were found to take place between my own house and the Royal Observatory, distant about a mile; but these, it will soon appear, were chiefly the results of the errors of construction, within the limits of which they were found to lie: they rarely exceeded a few hundredths of an inch. Between Perth and Edinburgh, similar differences, but much greater in quantity and in time, were found to exist; and, as in the first case, they were most conspicuous when the mercury was undergoing rapid and extreme changes. The differences in this example varied from 0 to 0,2, 0,26, 0,3, 0,5, 0,57; the actual difference of level in the two stations being sixty-four feet, not equal to 0,1 of the barometric column. I may here remark that it is not very unusual to estimate altitudes by this method, when the horizontal distances of the instruments have been even greater than this. Between Greenwich and Edinburgh, as might be expected, still greater differences were observed; ranging from 0 to 0,4, 0,55, 0,6, 0,63; and in this instance it was remarkable that the Greenwich barometer sometimes occupied the lowest station, contrary to the general rule respecting latitude. The difference of level in this case is only twenty-one feet. I do not think it necessary to detail more of these observations, as the general result was similar; and shall only further remark, that on comparing the register of Greenwich with that of Gordon Castle in Moray, some differences were found amounting to 0,8; the barometer at the former station being in that case the lowest. The difference of level between these stations is trifling, and this observation particularly serves to show that the rule respecting latitude is far from absolute.

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* I must here observe that in all these comparisons the differences of level between the stations were kept in view and allowed for.

It can admit of no doubt that these irregularities depend on analogous changes in the atmospheric pressure; as it will shortly be seen that they far exceed the limits of any sources of error from construction or temperature. Whether they are connected with the direction of the winds cannot be determined, from the want of sufficient meteorological observations; but this is probable, from the circumstance of their occurring most frequently in stormy weather or at the times of the greatest changes of pressure. The practical conclusions to be drawn from them are; that contemporary observations for the determination of altitudes are least worthy of reliance in proportion to the horizontal distance of the stations; and that observations which are not contemporary are not to be depended on absolutely, because one of the observed instruments has for a given time maintained a steady elevation; since the corresponding one may have nevertheless undergone considerable fluctuation.

It is now necessary to inquire respecting the differences and irregularities above alluded to as arising from errors of different descriptions in construction, and from other disturbing causes; for the purpose of determining to what extent they detract from the above conclusions, and how far they affect the accuracy of the instrument as a measure of altitudes.

A limited quantity of similar disagreements was found on trial to take place among several barometers at very short distances; but they were very trifling when the instruments were in the same room and the temperature constant. There are certain causes already well known as disturbing forces, of which some are capable of calculation and others are generally avoided in instruments of even tolerable execution. These are chiefly, a diameter of the tube too minute, varieties in the sp. gr. of the mercury, and variations of temperature. But I need not dwell on these and other circumstances already well known; since those which are not capable of being accurately determined, are productive of but trifling errors, and a ready mode of calculation is applicable to the others.

The error of chief moment, since it appears to be the cause of the non-coincidence between proximate barometers, and is also incapable of being estimated or corrected, is one compounded of erroneous construction and varying temperature. This has not been sufficiently noticed. It is better known to the makers than to the purchasers of barometers, that it is nearly impossible to make two act together under all circumstances. It is not often that the column is precisely of the same length in any number when constructed, and to conceal this defect the scales are adapted accordingly. These inequalities are diminished by boiling, but it is scarcely possible even thus to expel air and water from the tube; besides which the imminent hazard of breaking which it undergoes from the unequal heating, prevents this from being almost ever effectually done. In ordinary instruments it is not even attempted. Even when the tubes have been sealed when hot, and opened only at the moment of filling them with boiled mercury, air will still insinuate itself. It is this air which is the cause both of the unequal altitudes and the unequal oscillations in question. The variations of temperature above mentioned as affecting the movements of proximate barometers, act by influencing this substance; not by altering the specific gravity of the mercurial column itself; as will easily appear by computing the effect of such changes on the mercury according to the known rules.

The twofold action of air thus included is easily understood. When the column approaches its greatest elevation its motion is retarded by the increased elasticity of the confined fluid, a balance of forces being at length produced. Hence imperfect barometers show the greatest differences at their highest elevations; while even these all vary, in proportion to the quantity of air confined, and to the vacant space above the column. These inequalities are also the most sensible in rapid fluctuations, since the fall of the mercury will thus commence before the rise in such barometers has been completed. The effect of increased temperature is in some cases of the same nature, by increasing the elasticity of the confined air. But it also acts by producing a depression of the column at times when the mercury would otherwise be at rest.

From a knowledge of this circumstance a ready test for a barometer presents itself; namely, that of heating the tube above the column by the application of a hot body, and noting if any depression follows. From this knowledge also may be deduced an useful practical rule; that of bringing all barometers used in measuring altitudes as nearly as possible to the same temperature; as the only means of diminishing an error which to a certain extent appears unavoidable, and which in ill constructed instruments may be considerable.

It is now necessary to say that the limits of the errors from this cause, were estimated by exposing the barometers of imperfect constructions above mentioned to various temperatures, at different elevations, and under all the variety of change that occurred throughout one winter. Even where the construction was so bad that the instrument must have been unsaleable, and the changes of temperature were much greater than can ever occur in nature, the differences were never such as to amount to the least of those which were mentioned at the beginning of this discussion as having occurred between distant barometers. It is evidently impossible to give any scale for the correction of this class of errors, as the data are unassignable. But it remains certain, that the greater discrepances depend on causes in the nature and movements of the atmosphere, modified only by the minor errors of another class arising from construction. Although the former should never be discovered, nor the latter ever removed, this slight sketch will have its use, by exciting such a salutary distrust in barometric observations as will lead to the use of all the precautions in our power towards diminishing their inaccuracies.

UNDER the circumstances of a rainy climate which have already been mentioned, and in a country so constituted, we should expect to meet with abundance of streams. Such is in fact the case; but the interstices among the hills are so numerous, and the proximity of the shores to all parts of the interior is such, as to allow of no considerable accumulations of water. In the season of rain there may be torrents, but the streams of Mull are, when moderate, mere brooks. There is no one large enough to merit a particular description. There is consequently no material waste of land nor any considerable deposit of alluvium to be traced to this cause, since the plains at Scallasdale and in other places are of trifling extent; nor do there seem to exist either the accumulations of alluvia or the detached and insulated stones which mark the operations of a more distant and general cause. I shall now proceed to a particular detail of the several rocks which enter into the composition of this island.

In describing a country so complicated both in form and in structure as Mull, it is so difficult to make the geological coincide with the geographical arrangements, and at the same time to avoid repetition and confusion, that I have in this, as in similar cases, adopted the method most conducive to the principal object; the geological description. This consists in assuming the several rocks in a certain order from the lowest to the highest, and tracing each separately in its course through the several parts of the country.

With the single exception of Arran, this is the only one of the Western islands in which granite occurs, if I may also except the veins of this rock which traverse gneiss. It occupies a portion of the western and southern point of the island, being part of the district called the Ross, (or promontory), and, as I have formerly remarked, it extends even to the neighbouring shores of Iona. This portion may be defined by a line drawn between Sui and Ardchivoaig; its interior course being irregular, and, for want of more points of reference, unassignable. The granite forms round this rude coast a barrier of rocks, often naked, and even more so in appearance than reality, from the glaring distinction which their colour gives them. It is elevated into numerous round hills of no great height, and seeming indeed, in this high and mountainous country, much lower to the eye than their measurement shows. The highest do not probably exceed 800 feet, and in general they are much lower; while their unequal positions with respect to the coast tend to produce the very indented outline it here exhibits. This rock, like most others of its species, is so irregular in structure that it cannot be said to assume any one in particular. The most remarkable is the laminar, the laminæ, when inclined, having often at first sight the appearance of beds. They are frequently vertical, and are generally split by fissures in different directions, whence they sometimes present rudely prismatic forms. Occasionally they are of great size. The measure of one was forty feet in height by twenty or more in breadth; while another, of much less breadth, measured fifty-four feet in length. Entire blocks of very considerable though inferior dimensions, are numerous. The great size as well as the beauty of this stone would render it very valuable for architectural uses, were there any demand for works of art requiring such materials. Its vicinity to the sea and the facility with which it may be quarried are circumstances equally favourable; but they are perhaps rendered fruitless by the distance from London, the great mart of such an article, if any mart existed. There are two varieties of this granite, the one of a pale flesh colour, the other of a high red. It is large grained yet compact, and the mica is black, nor did I any where perceive any hornblende entering into its composition. In some places it slightly affects the magnetic needle; a property on which I have in another place made the only remarks that seem necessary.*

To the granite succeeds a belt of primary strata, conterminous with that rock on the western side, and bounded towards the east by an irregular line drawn between two points in the neighbourhood of Bunessan and of Shiba. The extent of these beds is consequently much greater on the southern than on the northern shore of the Ross. They are generally thin, and distinct, appearing to be very regular except where in the immediate vicinity of the granite. That regularity is most apparent on the southern shore, where they are most continuously accessible; and the dip here appears to be westward, although the angle is so high as frequently to approach the perpendicular. The direction of the elevated edges on both shores appeared to be about south-east.†

The rock which forms these strata consists apparently of an alternation of quartz rock and micaceous schist in some parts, while in others it puts on the characters of a schistose gneiss. It is unnecessary, after the remarks formerly made on this subject, to enter into more minute details respecting its mineral structure. Geologists will probably consider the whole series as appertaining to gneiss.

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* Geological Transactions, vol. iii.

† A fault having been detected in the compass after these observations were made, there is reason to suspect that the positions of the strata both here and at Inch Kenneth are not correctly stated. The error, if it exists, cannot now be corrected, but fortunately is not of much importance.

A long and interesting line of the junction of these rocks with the granite, can be traced at Loch Laigh, the shore fortunately lying in a direction oblique to the line of junction. It presents a very distinct view of appearances of considerable value towards the history of granite, which, however frequent in the mainland of Scotland, are no where within my observation to be seen with equal ease, and with equal freedom from doubts respecting their nature. In some places the junction takes place between the granite and the micaceous schist, in others between the former and the quartz rock. This is an important circumstance, since, these beds being parallel, the granite is not parallel to them, being sometimes found in contact with the one, and sometimes with the other. It occupies therefore a position which may be represented by the subjoined design.* In the rocks which can be proved to follow each other in a conformable and stratified manner, the flat surface of any one stratum is every where in contact with that of the next, and by this character they are known to have regularly succeeded each other from the bottom upwards, even when no other proofs of this are present. Here, there is no such consecutive order, the quartz rock which is in contact with the granite in one place being removed from it by interposed beds of micaceous schist in another: an appearance which we should not expect had these rocks been deposited in succession on an uneven basis. This circumstance occurs in other situations in similar cases, and presents an argument in favour of the posteriority of granite to the stratified rocks under which it lies.

In some parts of this junction the stratified rocks lie in contact with the granite without much loss of their original straight direction; the ends of the strata in some cases, and in others their sides being united to it, and so firmly adherent that they can scarcely be separated. In others, a disturbance takes place in their even direction, particularly where veins are found passing from the granite through them. These veins are of various sizes, and ramify in a manner too well known to need description. At the places of contact there may often be observed fragments of the different stratified rocks, detached from the main body and imbedded in the granite. These are of different dimensions, from that of an inch or less, to many feet; and they are in some instances so distinct that the parts whence they were separated may be traced, and the fragments re-united by the imagination. A diagram is subjoined for the illustration of this important phenomenon*, which occurs also in many other parts of Scotland; among others in Glenco, in Rannoch, and in Braemar.

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* Plate XX. fig. 8.

The last remarkable circumstance is the change which the stratified rocks undergo at these points of contact. In these places the quartz rock becomes red, and is found to contain felspar in large proportion, often putting on the appearance of fine grained gneiss; and it frequently also passes into the granite by a transition nearly imperceptible. The micaceous schist in the same situations becomes a real gneiss, not to be distinguished in hand specimens from the most regular rocks of this class. These changes are however extremely partial, commonly extending but a few inches, rarely to a few feet beyond the junction, and vanishing gradually as they recede from it: this phenomenon also occurs in similar situations in Glen Tilt.

Although unwilling to repeat the trite arguments derived from the nature of granite veins, I cannot avoid remarking the strong support they receive from the circumstances now mentioned, particularly from the fact of the imbedded fragments; an appearance which cannot be reconciled to any supposition yet offered, except that of the posteriority of granite.

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* Plate XXVI. fig. 2.

The junction of the primary strata with the trap, on their eastern margin, presents but little interest; nor is the actual contact often to be seen, the mutual boundary of the two rocks being generally overwhelmed with rubbish. On the northern shore the line of junction is narrow, although visible, the land being but little elevated above the sea. The trap here abuts against the stratified rocks, protruding both above and below them so as to entangle a portion, and giving as satisfactory evidence as we can expect, of the junction and of the boundaries of the two. On the southern shore there is an interval filled with rubbish at the point where they meet, and the same occurs on the surface of the interior wherever I examined it; a circumstance, as I have remarked on other occasions, of general occurrence. It is scarcely necessary to add that veins of trap are found proceeding from the main body and penetrating these strata.

The description of Inch Kenneth will illustrate the position and connexion of those primary strata that occur on the shore under Gribon and Torosay. The quartz rock, (or gneiss) with the superincumbent secondary strata, is found occupying that shore for some miles; commencing near to Inch Kenneth, and terminating at a nameless point which is noted in the map. The beds on the northern portions of this line are regular, even, and thin; circumstances easily traced, because their broken edges are placed outwards so as to form the cliffs. They vary in the quantity of their inclination in different parts of this line, but the dip is pretty uniformly S. S. E. or thereabout. Near to Inch Kenneth they are elevated to thirty degrees, becoming shortly horizontal, and then again rising to an angle of fifty degrees. In their composition, the different rocks resemble both those of Inch

Kenneth and those which I have just described as found at the Ross; leaving no doubt that they form a portion of the series already discussed. It is equally probable that the whole of these are parts of the gneiss which constitutes the adjoining mainland of Morven and the islands to the westward; disjoined, as in Sky, by the trap which forms the bulk of the island.

At a point which I can only mark by saying that it occurs where Staffa and the rock of Ardnishker are seen in one line, these strata suddenly disappear in the upper parts of the cliff, being apparently overwhelmed by the slope resulting from the fall of decomposed trap from above. But they are still seen for a space along the shore, and finally terminate where the point of the Ross of Mull cuts the cathedral of Iona. The trap rocks then occupy the whole shore; but I must delay any remarks on them until I have described the remainder of the stratified rocks with which they are connected.

The next in order are the secondary strata. These occur but in small quantity, and occupy positions so disjointed and obscured by the trap rocks, that it is no less difficult to describe than it is to discover them. When it is recollected how often chance must conduce to the discovery of rocks so insulated, it will not be surprising if some have escaped my notice. Such omissions are, in a geographical view, blemishes which it would be desireable to correct; and where such materials as sandstone and limestone are in question, they may be serious defects in an economical view. But a survey that shall accomplish every thing, must be a work of time; nor will any thing be contributed towards it by him who fearful of being wrong where it is as yet impossible to be always right, and unsatisfied with the best he is able to attain, delays the record of his observations to the period of perfection.

The relations which the disjointed substances that form these strata, bear to each other and to the primary rocks, can scarcely be discovered from the appearances visible in this island. But they may be deduced from analogy, and from an extensive comparison with each other and with the adjoining shore of Morven. From these it follows that the limestone is most probably the lowest of the series, and I shall accordingly commence the description from the most extensive portion of that rock which occurs.*

This substance is so difficult to recognise among the trap in which it lies, although extending for many miles, that it has hitherto been confounded with that rock by those who have examined this island,† and is equally unknown to the people of the country. The length of its range may be seen in the map, but it must be remarked that the belt of colour by which it is indicated is not meant as the measure of its breadth, since it occupies no space horizontally, being only seen in the vertical faces of the cliffs. This expedient, as in the map of Sky, is however unavoidable. In tracing the southern shore of the island from Loch Don, trap only is found for a considerable space. But at a point to the east of Loch Speliv, the limestone commences and continues to Loch Buy, being interrupted in its course only by the opening of the former inlet. Along the whole of this range it occupies the lowest position on the shore; projecting near the level of the sea so far from the cliffs as in general to admit of a passage along their base, when the state of the weather does not prevent a boat from occasionally landing so as to assist the observer in passing some of the most difficult points. It is not easy to estimate the proportion of the cliffs which it forms, as, when sufficiently near to distinguish between the limestone and the trap, the foreshortening of the height prevents a correct judgment on this point; and when at a proper distance for this purpose, it is not always possible to discriminate between the two. I need scarcely say that these cliffs are utterly inaccessible, and that they are invisible from the land above. But as far as a judgment can be formed, nearly the whole cliff is limestone, the trap which surmounts it in this part of the coast and forms the high hills of the interior country, terminating by a comparatively thin edge at the top of the vertical face. There is no reason to suppose that any considerable sandstone strata lie above the limestone throughout this space; because no fragments of the former are found upon the shore below, and because where those strata actually occur, they are distinguishable from the limestone at a distance. The height of these cliffs being considerable, the mass of limestone is consequently of great thickness, varying from 200 to 400 feet, as the precipitous face gradually rises from Loch Speliv to Loch Buy. The strata enter for a certain space within the mouth of that bay and then disappear among the trap. On its western side they reappear at a corresponding point and at the same altitude, continuing for more than a mile along the southern shore, and, as before, occupying nearly the whole thickness of the cliff from the sea to the surface. At this point however the body of strata quits the shore, but is still continued without any sensible alteration of its dimensions as far as Carsaig. It thus lies between two masses of trap; that rock skirting the shore to a certain elevation as far as Carsaig, and also surmounting the strata as in the eastern part of the coast. Here the limestone appears to terminate, but it will immediately be seen that the strata of sandstone usually associated with it are continued in the same manner, and without discontinuity, to the western cliffs of Inimore. There are probably some alternations of the two rocks at the point of change, and it is also not improbable that the sandstone may exist among the upper parts of the strata already described; but the distance at which they must be viewed does not permit the distinction to be made.*

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* Plate XX. fig. 11, 12.

† No censure is implied by this remark. He who has experienced the difficulties which the geologist must encounter in this almost inaccessible country, has felt the toils and privations that must be endured, and knows the obscurity in which the subject is here peculiarly involved, is more likely to offer the apology of those who have left any thing undone, or have misconceived the nature of the appearances before them. He knows not how soon he may himself want the same indulgence.

As it would be inconvenient to defer the consideration of this sandstone till the other portions of that rock occurring in Mull are described, I shall now add that it occupies in the cliffs a similar situation to the limestone. In proceeding from the eastward it is at first found on the shore, but it gradually rises until at length it terminates by a single bed situated between the superior and inferior trap.

As the characters of this sandstone are similar to those of the analogous strata occurring in Sky and Rasay, it is unnecessary to detail them. It is equally apparent that it here bears the same relation to the calcareous strata as on the north-eastern coast of the former island; being generally superior, but apparently alternating by a few thin strata at the place of change. If there be any considerable proportion of shale in this part of Mull, it is undistinguishable, from the difficulty of access; but as this substance occurs with the coal of Carsaig in the only point where the strata admit of examination, it is not improbable that it also forms a part of that mass which I have supposed to consist of limestone.

The characters of the limestone are also analogous to those of the calcareous rocks which occur among the trap of Sky, Muck, and other tracts similarly constituted. Its colours are various tints of grey, sometimes mottled in a singular manner; the rock being often crystalline, and commonly so highly indurated as to be difficult to recognise, while the parallel aspect resulting from stratification frequently disappears. I no where observed any indications of organic remains, although it is probable they exist among those beds which have undergone the least alteration.

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* Plate XX. fig. 11. This diagram may be considered as a representation of the whole southern shore of Mull from a point north of Duart to the Ross, the objects being all brought into one vertical plane and the relative proportions of the parts so altered as to adapt them to the indispensable size of the plate. The true proportions may be gathered from the Map.

The peculiar situation of these strata renders it impossible to ascertain their dip with correctness, the more so as they are often considerably undulated. Yet there is a general tendency toward the north-west in the only places where the form of the ground permits observations of that nature to be made. It is almost superfluous to add that they are traversed and intersected in every direction by innumerable veins of trap. The appearances hence produced are highly interesting; but the remarks already made on the coast of Trotternish in Sky have exhausted all that could be said on this subject.

The next portion of the secondary rocks to be noticed is found near Achnacrosh, forming a small hill and extending to the sea shore, where the directions and inclinations of the beds can readily be traced. These consist almost entirely of limestone, presenting two or three different varieties of colour and texture. The predominant colour however is smoke grey passing into a paler grey, and the general character is argillaceous. In one or two places, where trap veins interfere, the beds assume a darker colour and a crystalline aspect; while in others, under similar circumstances, both the colour and texture remain unaltered, although the regularity of the beds is interrupted, and a confused structure takes place of the regularly stratified disposition. The general direction of these beds is N. N. W. and their dip easterly, at angles varying from forty to sixty degrees. They contain gryphites, terebratulæ, and belemnites, the former being by much the most abundant. I must remark of this fossil that it is a different species from that found in the lowest limestone of Sky; the specific distinction being strongly marked by the peculiar form of the shell, although these species have not as yet all received distinct names from conchologists.

The trap veins that traverse these strata are in general so far parallel to them as to have the appearance of beds; but their real nature is detected by their occasional interference, and by the numerous ramifying veins which they send into the adjoining limestone.

The distant view of this shore, characterized as it is by its flatness for a considerable space inland, naturally leads the geologist to expect that the whole is formed of secondary strata; particularly as all the other parts of the island which consist of trap are hilly, if not mountainous; and he is not a little disappointed to find even the flattest parts composed of the overlying rocks throughout their whole extent.

The last portion of the secondary strata which came under my notice consists of sandstone, and is found on the western shore of Gribon, being most remarkable at that part which lies opposite to Inch Kenneth. The reader is prepared to understand the appearance and position of these strata from the description already given of that island. They are found there lying on the elevated edges of the primary strata, in the position called unconformable. This is also the case in certain places under Gribon; but the rule is not universal, and as the position of this secondary rock in relation to the primary is material in a general view, it is illustrated by a diagram.*

It will be seen by this diagram that the strata are here horizontal, or nearly so, above, and they would thus be considered, like those of Inch Kenneth, unconformable, could no further view of them be obtained, since, were they prolonged, they would occupy a similar position. But if they are examined at a lower point, they will on the contrary appear to conform to the primary strata; a circumstance which, incorrectly observed, has occasionally been a source of error in geological observations.

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* Plate XX. fig. 10.

The next diagram* shows more distinctly, that the conglomerate and sandstone which form the secondary set of strata, are deposited on the faces of the primary, and that having filled the cavities which these may contain, they assume first the horizontal and ultimately the reverse position, their prolongations over the edges of the strata becoming by inference unconformable.† The last sketch‡ will show how such a stratified rock may be actually conformable or otherwise, and it may be considered as a representation of these rocks before Inch Kenneth was separated from Mull, one portion being actually visible in the former island, and the other in the latter. It is obvious from this statement that nonconformity is not a test of distinction between the primary and secondary strata.

One general conclusion may be drawn respecting the mode of connexion between the primary stratified rocks and granite, from the manner in which the secondary strata are deposited on the primary. I have shown that the irregularities of the gneiss in Lewis, and the similar cavities formed by the re-entering angle which lies between the sides and ends of the primary strata in this place, are filled with the conglomerate or secondary rock, which, as soon as it has attained a level, becomes regularly-stratified; proving that it has been deposited in a gradual manner on a surface previously irregular. This is unlike the phenomena at the granite junctions, where every thing is disturbed and broken: repose, in short, marking the one and the reverse the other.

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* The drawings from which these diagrams were constructed, are real views of different points on the shores of Gribon at the junctions of the conglomerate and the primary strata.

† Plate XX. fig. 7.

‡ Plate XX. fig. 6.

With respect to composition, these strata are so similar to those of Inch Kenneth that I need not repeat the description. They are however seldom very accessible, as they lie high in the cliffs, and are much overwhelmed by the trap and rubbish above them. The sandstones contain in some places alternate beds of limestone; more perhaps than I noticed, since great calcareous infiltrations and stalactites may be found in the cavities which lie under them; but this, as is well known, may arise from the calcareous particles in the rock. They terminate by sinking under the trap or the sea, at the point where the primary strata disappear.

The small quantity of coal which has hitherto been discovered in Mull is limited to two spots. The least remarkable of these is a thin stratum found under the trap at Ardtun; too insignificant to be of any value in an economical view, and offering no interest, in a geological way, different from that of similar strata in corresponding situations. The next is a bed of more considerable dimensions, attaining a thickness of nearly three feet. It is situated near Carsaig, in the strata already described. Different attempts have been made to work this coal; since the entire want or great scarcity of peat in many of the smaller islands, and the inconvenience and expense of making it in all, at a time of the year when the operations of agriculture require much attention, render it both expensive and inconvenient; often indeed limiting the fuel of a Highland family to a very insufficient allowance. These attempts have however been successively abandoned shortly after they were undertaken; and it is not now possible to procure any distinct information respecting the cause, as neither the undertakers nor those who were employed in the work are at present accessible. It is probable that here, as in Sky, the difficulties have arisen from the interference of the trap. The analogy between the two cases is such as to render unnecessary any further details respecting this coal, which evidently appertains to that which is dispersed throughout the secondary strata, not only in the islands formerly examined, but in the neighbouring continent of Morven.

On reviewing the whole of the strata which have thus been described, it is apparent that they all belong to the same deposit; whatever anomalies they may display, either in their relative dispositions or in their connexions with the surrounding rocks. It is evident that the limestones on the east side of the island are parts of the lias series, which has been already pointed out as existing in a similarly dispersed manner in some of the islands before described. It is equally evident from the facts already stated, that the southern limestone appertains to the same beds; and there is no reason to doubt that the sandstone on the western shore belongs also to this series, although here very incomplete, and widely separated by the intervening trap from the southern and eastern portions.

In this island, as in others of the same character, the separation of these now divided portions appears to have resulted from the interference of the trap rocks. But it is unnecessary to dwell on matters discussed in so many other places; particularly as the examination of Sky has already superseded all that could be offered on the subject, and as I shall hereafter, in giving a general view of the Trap islands, have occasion to examine the mutual connexions of all these dispersed strata with each other and with the adjoining mainland.

It is now necessary to describe the trap rocks. These occupy by far the largest, although, to the geologist, the least interesting portion of the island. It would not be possible to give a full description of all the varieties of these rocks or of the circumstances attending them, without repeating the observations made on Sky or on the other islands where they exist. Nor can it be necessary, as the chief interest of such details consist in their scientific, not in their topographical importance.

Throughout the whole northern division of the island no circumstance presented itself sufficiently rare or remarkable to deserve notice.* The trap occupies the whole land from the sea to the surface, and is disposed universally in flat terraces. Columnar forms are not uncommon, and they are varied by the usual disorderly recurrence of greenstone, basalt, trap porphyry, amygdaloid, and trap conglomerate. Fine specimens of analcime, as well as of mesotype and of stilbite, are found in different places; together with red ferruginous clay and occasional specimens of prehnite.

The middle trap district lies in the divisions of Torosay and Gribon, and is incumbent on the primary and secondary strata already described. It rises to a great elevation, apparently not far short of 2000 feet, and, like the northern division, is also disposed in terraces; its broken western side exactly resembling the western cliffs of Sky, and containing similar alternations of the several substances found there. It is traversed by great veins of basalt, which also cross the strata beneath, and of which some are so remarkable for their schistose structure that it is with difficulty they are distinguished at first sight from beds of blue slate. Columnar forms are not abundant among these rocks, but some of a very remarkable character are to be seen on the shores opposite to Loch Laigh. These are for the most part curved and implicated in various intricate directions, generally surrounding the openings of two or three small caves that occur in these cliffs. They pass gradually into the amorphous basalt which constitutes the body of the hill. Among them are to be found some groups of straight columns of a small size, being from six to nine inches in diameter, and of great regularity and beauty; constituting specimens of convenient dimensions for collectors of minerals.

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* I shall not be surprised if hypersthene rock should be found in this part of the island, and beg to point out the shore between Loch Mingary and Bloody bay as requiring a more accurate examination for this purpose than the weather allowed me to bestow on it.

Of the amygdaloids found here I may notice two varieties, as being uncommon. One of these is a soft grey rock of a texture resembling indurated clay, containing nodules of chlorite of different sizes, hollow and crystallized within; similar to those occurring in the hill of Kinnoul, but more perfect and more numerous. The other contains quartz nodules, together with rounded nodules of heliotrope, of a dark green colour, but without that variety of aspect which is to be found in them in Rum.

The last substance which it is necessary to notice as occurring in this trap, is carbonized wood. I shall particularize only one of the spots where it is found, because I am enabled to give a sketch that will render it intelligible.* There are others, but not of such easy access. This substance is contained in a perpendicular vein, about fifty feet in height, and five feet in breadth, the lower end of which reaches to the shore;† the upper terminating abruptly in the mixture of solid and columnar basalt by which it is every where surrounded. The upper part of this vein is a conglomerate of soft grey trap fragments imbedded in a paste of the same materials. Toward the bottom it varies and becomes mixed with a black substance, which on examination is found to consist of minute fragments and a fine powder of carbonized wood, the vegetable organization being still visible in the former. Amongst this black matter a portion of the trunk of a tree appears, in a direction parallel to the side of the vein, and therefore erect, being entire and unbroken for the space of at least six feet. It is traversed by a vein of crystallized lime spar. On careful examination of this wood it appears to be fir, which at least it perfectly resembles in its anatomical structure. In its chemical nature it resembles the species of lignite known by the name of Cologne earth, and like that, it forms a most beautiful intense brown paint. The phenomenon of wood in basalt has been often quoted as an argument against the igneous origin of that substance. Whatever conclusions are to be drawn from this fact, it is at least necessary to be accurate in stating it; and I believe that in all the instances hitherto described, the wood has, as in the present case, been found in a conglomerate or in some other rock, either lying under, or entangled in the basalt, and not in the basalt itself. In none of these cases does it appear to prove any thing either for or against that theory. Wood, it is well known, can be carbonized by the action of water as well as by fire, and as yet no instance of this nature has been brought forward in which the action of either might not equally have produced the effect. If there is a difficulty here peculiarly worthy of remark, it is the circumstance of a vein being thus filled with a conglomerate and containing at the same time a ligneous substance, like this, so little disturbed. It adds one more to the number of conglomerate veins of which I have already described a remarkable instance in Lewis. I must not conclude the examination of the middle district without remarking that this trap extends with little or no variation along the north shore of Loch Scredon, in low terraces, often assuming columnar forms. In one place it entangles a mass of the primary strata, the only instance in which these rocks are found on the northern border of this inlet.

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* Plate XXI. fig. 1.

† These proportions are neglected in the sketch for the convenience of giving the more interesting part of a sufficient size.

The southern district, which occupies the whole southern line of shore from the termination of the primary strata to the sound of Mull, and is bounded to the north by Loch Scredon, displays, like those already described, almost every modification of external aspect under which the trap rocks are to be found. Columnar forms occur with considerable regularity along the shores of that inlet; but the land being little elevated, the ranges are low. As the interior country is generally well covered with soil in this district, the peculiar characters of the rocks are not readily discovered; but it is easy to see that the terraced forms are less prevalent than in the northern parts of the island, or that the trap has not here the stratified appearance by which it is in that division so strongly characterized. There are indeed few circumstances in the characters of the trap rocks more remarkable than the infinite diversity of disposition which they assume. At times they are massive, irregular, and shapeless, rising into unwieldy mountains, the distant outline of which gives no clue toward the discovery of their composition. In other cases their summits are spiry and rugged, resembling the forms so often assumed by granite; while occasionally they have that round and flowing outline which has been judged characteristic of the schistose structure, and by which Wales and Cumberland are distinguished. In other instances they exhibit that very remarkable terraced form and scalar outline from which their name has been derived, and which is almost sufficient in itself to justify us in pronouncing on their nature even from a distant and general view. This form is found to depend on the stratified position in which they are placed; and the shores of these islands afford numerous opportunities of observing the very accurate and parallel dispositions of the beds. In other situations, of which examples are no less abundant, they present the appearance of irregular and angular rocks, bearing very little resemblance either to their own more usual forms, or to the general character of any other class of rocks occurring in this country. The eastern part of this district lying in the vicinity of Achnacraig, produces examples of these undefinable and anomalous shapes.

As it has been a common opinion among geologists that every rock with which we are acquainted as forming mountain masses, possessed a peculiar outline and gave a corresponding character to the mountain outlines of a country, so that from these a tolerable conjecture could be formed respecting its composition, it will not be improper to introduce here a few remarks for the purpose of examining into this prevalent notion. The observations that have occurred to me have led to the conclusion, that no general rule can be laid down for any particular class of rock, in which the exceptions will not be found at least as numerous as the examples in favour of it. I would willingly have given plates illustrative of these circumstances, but that a volume would scarcely suffice to place them in a proper manner before the reader. I shall therefore limit these remarks to the enumeration of such instances as are most accessible and best known, confining them at the same time to a few of the most conspicuous rocks.

The spiry outline of the granite of Switzerland is known to every one, and forms exactly similar are to be seen in the mountains of Arran. Here then is a decided character which the painter recognises and can distinguish strongly. But the geologist who determines from these instances that every spiry outline implies granite, or that where there is not such an outline, granite does not exist, will be deceived. If in this country he proceeds to Cruachan he will find a simple conical outline, that particular boundary which is so often affected by quartz rock. A step further brings him to the ridge of Cairn gorm. Here is a lumpish form and a smooth rounded line resembling those of the schistose mountains of Wales, and without a single harshness or projection to vary its uninteresting features. Further on, he comes to a land of low undulations, of which if he were to judge from the outline alone, he would conclude that he was surveying a coal field or an undulating mass of secondary strata: yet this is the granite of Aberdeenshire. If we resume the spiry outline once more, we shall find the Cuchullin hills marked by a high and strongly serrated boundary, rising into spires and pinnacles more lofty and rugged than those of Arran; and here the geologist is surveying the picturesque forms of trap. Even the breccia of Montserrat presents similar characters, exceeding in decision those already enumerated.

But the mountains of Sky afford examples also of the outline most contrasted to the former, smooth, round, and undulating. These are formed of a different member of the trap family; while the same rocks in Mull tend to the simple conical shape, and in Arran subside into gentle undulations not to be distinguished from the outlines of Radnorshire, or the swelling and flowing lines of Dartmoor.

Hills of quartz rock are generally characterized by the simple conical outline. Yet there are many exceptions to this rule. Although true in Jura and in Assynt, it does not hold good in Ben Gloe, where the outline is rounded; the eye being unable to distinguish by their picturesque features, the summits of quartz rock from the neighbouring hills of granite. It is unnecessary to detail the forms assumed by micaceous schist, since, among the infinite varieties of this rock, examples of deviation from any imaginary standard may be seen all over Scotland; from the serrated summits of Cowal and Ben Venu to the conical elevations of Ben Lomond and Ben more, and the undulations of Knapdale and Cantyre. The same remarks might be made on gneiss, but they are rendered unnecessary by the description of this rock already given in a preceding article. The southern division of Scotland is in itself a sufficient example of the fallacy of such a rule. Almost uniformly undulating over a large tract, without the slightest variation of character on which the expressive touch of a painter can rest, the geologist finds it to contain sandstone, trap, schist, porphyry, and granite.

I need not add to the few remarks already made on the versatile outline of the trap rocks. Instances of diversity which do not require enumeration, are known to all those who have examined this country with the eye of an artist and the hammer of a geologist. It is enough to have pointed out the fallacy of the rule as a caution to the observer; who should convince himself, if he is not already convinced, that he can be certain of nothing which he has not touched. But to return to the description of the trap which forms the southern district of Mull.

The most striking of the exposed rocks in this part of the island, are those which form the high cliffs of the southern shore and stretch in a mural line from Inimore towards Loch Speliv. These are of considerable altitude, as already noticed, varying apparently from 300 to 600 feet. Most of the various forms of trap, and, among others, the columnar, are to be seen ranging along the cliffs in a stratified disposition, incumbent, and occasionally alternating, as already mentioned, with the secondary strata. In passing Loch Buy towards the east, the altitude of these cliffs diminishes, and at length gradually subsides into the low shores which extend from Loch Don to Duart bay, and beyond that towards Scallasdale. Throughout this latter tract the external character of the rock is changed, but I need add nothing to that which has already been said respecting it. I may merely remark that the hardest kinds contain abundant amygdaloidal nodules of the differeut zeolites; substances in general much less frequent in the hard than in the soft varieties of this extensive family.

Every geologist who is familiar with countries formed of stratified trap, must have been struck with the general horizontality and evenness of the strata that enter into their composition. This is remarkable in Sky; it is even more so in Mull, where high mountains, as those of Gribon may be called, are formed by the repeated superposition of one horizontal bed over another; and where the declivity is the result of vertical fractures, by descending steps, either of each successive stratum, or of a more extensive series. In this latter case the boundary of a mountain is either a single vertical cliff or a succession of two or more such; some gentle descents being almost always found among these precipices, from the slopes generated by the fallen fragments. The subjoined diagram* will give a better notion than words of the forms in question: its outline is in fact almost a representation of the mountain which constitutes the promontory of Gribon. In examining the positions of the strata which form the primary, and even many of the secondary mountains, it will be found that the beds which enter into their composition are rarely if ever continuously horizontal. They are sometimes bent, at others partially elevated, or now and then even vertical, as represented in the other diagrams;† the existence, as well as the declivities of the hills appearing to have been the result, either of an elevating force, or of a subsidence, by either of which the appearances might have been produced. But the absolute horizontality of the trap beds shows that these remain in the position in which they were first formed. The period of this formation is obviously posterior to that of the latest stratified substances with which we are acquainted,‡ since this class of mountains is found covering those substances even to a considerable depth. That no general disturbance and fracture of the earth's surface has taken place since this period, is proved by their freedom from dislocation and change of position. It is difficult to comprehend by what means horizontal deposits of so partial a nature are found occupying positions so elevated. But to whatever causes their formation may be assigned, it is at least evident that their origin, recent as they may appear in comparison with others, is removed to an immense distance, and that the surface of the earth must have undergone material changes, from causes operating quietly through a long space of time, before these extensive strata could have been shaped into distinct mountains by the abrasions of their edges or the loss of extensive portions; before the separation of Staffa from Mull, for example, could have taken place. The true solution of these cases may perhaps never be discovered; but assuredly no theory of the earth can be just which is incapable of being reconciled with the phenomena displayed by the latest rocks of the trap family.

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* Plate XX. fig. 1.

† Plate XX. fig. 2, 3, 4, 5.

‡ I must here perhaps except some of the most recent partial formations.

The last rocks to be described are those which occupy the mountain district.

In examining this tract I must regret that I can neither define its geography more accurately, nor its geological features with greater precision. The climate of this most rainy island is not less inimical to accuracy of research than its trackless and uninhabited mountains. But a little defect of accuracy in asssigning the boundaries of cognate rocks, will not probably be considered of any moment in a survey of this nature.

I need scarcely remind the reader that all the trap already described, is characterized by a peculiarity in the external outline, entirely different from that of the rock which constitutes the mountain tract. I have already pointed out the same circumstances in Sky, to which Mull has in this, as in many other respects, a strong resemblance. To what extent these forms may be connected with geological circumstances in the origin of each district, I am unable to conjecture. As far as I have examined, it is impossible to trace such a connexion between these mountain rocks and those stratified traps with the relative antiquity of which we are tolerably acquainted, as to be enabled to determine their comparative situations; or whether indeed there is any difference between them in point of time. It is not improbable that there is such a distinction, but I know not that any proofs of it have yet been produced. In the composition of the substances there is often but little difference; or at least, every variety is in some place or other found disposed in both modes.

At the foot of the hills which rise to Ben more from Loch na Keal, great beds of trap are seen exposed by the casual sections of water courses, but there are no precipitous faces; while the surface being thickly covered with soil and vegetation, access to the rock is rarely obtained. These beds are horizontal, or but slightly inclined, yet their edges never terminate by stairs like those of the trap before described. In ascending that mountain their regularity varies, and they become inclined as well as curved; until it is at length impossible to trace either form or position, the whole appearing to be a confused mass shattered in every direction. It is equally impossible to define the place of this transition: it is even uncertain if any defineable boundary exists; and the same difficulty, it will be remembered, occurs in Sky.

The composition of this rock is very little varied, and for want of a better general term, that of claystone may be adopted as least exceptionable.

In general the claystone of Ben more is of a pale blueish grey, sometimes varying to a very light tint, comparatively soft in its texture, and of a mealy aspect. Occasionally it puts on the hardness and sharpness of basalt; passing through various stages of induration into clinkstone or compact felspar, but retaining its pale blueish colour, and resembling in every respect some of the varieties which occur in Sky and in Arran. In a few situations it is found splitting in a schistose manner. This however is not to be effected by force, but is the result of the action of the weather, the laminæ thus detached being sometimes straight, at others undulated. I observed only two varieties with foreign substances imbedded, the one containing nodules of green earth, the other compact zeolites, apparently solid mesotypes. These latter are occasionally in such abundance as nearly to equal in quantity the stone which contains them, and I must remark that they are rarely known to occur in the claystones of this character.

As in Sky and in Arran, many other varieties of trap are found among the mountains of this district, but it is unnecessary here to enter into any details respecting these. Enough has been said of them in a geological view, and I shall on some future occasion have a better opportunity of discussing this subject as far as regards the nature and distinctions of the mineralogical varieties.

Connected with these rocks is found a considerable tract of the same syenite which forms so conspicuous a feature in Sky. It may be traced through the hills Ben y chat, Ben greig, and Cruach ruilin; and, from the indications given at a distance by the contrast of its reddish colour with the blue tint of the rocks last described, it appears to occupy a considerable portion of the impracticable country to the eastward. It is more easy in this place than in Sky to trace its connexion with those rocks. The change may be observed in Ben y chat, and, at the place where it is effected, the blue rock first passes into a brown variety, the character of which is very distinctly marked and resembles precisely that of an analogous rock which occurs abundantly in Arran and in Lamlash. The transition from this to the syenite, immediately follows, without any apparent irregularity of the very obscure beds which form each, and without any evident discontinuity except in colour. The change of the one substance to the other in the very same bed is not so gradual here as in Rum. It bears however no resemblance to a superposition of distinct rocks; since there is no greater regularity in the beds than that which occurs in granite, and as at a lower point in the hill, the syenite once more gives way to the claystone. This example, when compared with the transitions of the analogous rocks in Rum and St. Kilda, and the probable circumstances of the same nature occurring in Sky, as well as those hereafter mentioned in Arran, are sufficient to prove that this syenite is only a portion of the trap formation, geologically considered; being connected with it in position, simultaneously formed, and bearing with it a common relation to the surrounding rocks. Nor is the mineral composition of the two separated by a decided line, the change being effected in a manner similar to that which occurs between the augit rock and the syenite of Rum.

Such are the rocks which, as far as my observations extended, compose the island of Mull. But I must not terminate this account without mentioning the frequency of trap veins throughout the island. These are indeed so invariably present in all parts of Scotland where trap predominates, that I have rarely thought it necessary to give a particular description of them, unless where they were attended with unusual or instructive appearances. I know of few such in Mull. They are frequently conspicuous for their permanence after the surrounding strata have been removed, a character which they also possess in Isla, in Jura and elsewhere. One of them has been described in high colouring by Faujas de St. Fond, but there are innumerable others far more conspicuous in the northern division of the island.*

In reviewing some of the amygdaloids collected in Mull, I discovered a non-descript substance intermixed with some prehnite, but too small in quantity for examination. Having since found the same mineral in greater abundance in Glen Farg, I shall give the best description of it I am enabled to do from those specimens, as I cannot now assign the exact locality of the former. It has hitherto escaped the observation of mineralogists, and the description, however imperfect, will therefore be of use, by directing their attention towards it, and thus, possibly, ascertaining its existence in other places.

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* I must add to this account of the rocks of Mull, that loose fragments of pitchstone have been found by Mr. Greenough upon the southern shore.

Its external characters are very limited, since it consists of a loose white powder, somewhat coarser than silica as it is obtained from the silicated alkalies, gritty between the teeth, but not so hard as to scratch glass.

It does not effervesce with acids, and before the blowpipe it melts immediately into a transparent colourless bead with apparently the same facility as glass. It is certainly at least more fusible than datholite. I have not been able, from its condition, to determine its specific gravity. On attempting to analyze the very minute quantity that could be spared for that purpose, it was found to consist principally of silica. A small quantity of lime was taken up by muriatic acid, but its fusibility was not destroyed by that treatment. When treated however in a similar manner with sulphuric acid, the fusibility was destroyed. No alkali was found in it, nor any boracic acid, nor any traces of metallic matter. It is not easy therefore to account for its great fusibility unless it should contain the new alkali. In this uncertain state must its chemical composition remain, until other specimens are procured to admit of a repetition of these experiments on a more extensive scale.

It is found filling irregular cavities in the amygdaloid of the valley above mentioned, so well known to mineralogists; where it is accompanied by analcime, mesotype, prehnite, and calcareous spar. There is no appearance of decomposition in the accompanying minerals, and I may add that the specimens in question were broken from a fresh rock in which they were deeply imbedded.

The preceding characters seem sufficient to distinguish it for the present from all the mineral substances hitherto described; and the term conite appears well adapted for it, as being expressive of its most conspicuous feature.*

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* On this substance I shall only remark, as I recently did in treating of Rum, that it is preferable to erect a species, though it should afterwards prove a variety of some known substance, than to neglect the obscure characters which minerals often present. It is to greater accuracy of research and of knowledge that we are indebted for the recent rapid augmentation of the list of minerals.

ULVA,* GOMETRA, COLONSA, EORSA.

Were it not for the purpose of completing the mineralogical map of the Western isles, it would scarcely have been necessary to mention these, since both in external aspect and structure, they are identical with the neighbouring coast of Mull.

Ulva and Gometra are separated from each other by so narrow a sound, that from most points of view they seem to constitute one island. The former is divided from Mull at its eastern end by a shallow and narrow arm of the sea, which increases to a wide bay where it separates Gometra from the same island. The latter appears to attain an elevation of about 800 feet; Ulva, one of 1300 or 1400; both being composed of repeated ranges of terraces rising in succession from the shore to the summit. These present rocky faces of dark blueish trap, either amorphous or marked by a columnar tendency. On the shores, some low but very well formed ranges of columns are to be seen; and in sundry places an amygdaloidal mass is also visible, abounding in the two varieties of zeolite most common on this coast, mesotype and analcime, of which the latter is the most abundant. There neither appears any general rule respecting the relation between the amygdaloid masses and the solid trap, nor are there any continuous beds of the former substance. They are sometimes wanting altogether, at others they are placed either above the trap or below it, and in some cases they are interposed between two ranges of columns. Although these ranges seldom exceed twenty feet in height, they are very numerous, since they skirt the whole south-western shore of both the islands. They are never continuous for a great space, being separated into detached parts which have in many places a very artificial appearance, resembling fragments of walls and ruined towers. They are often as regular as those of Staffa, although on a much less scale, and pass gradually from that regularity of form into the most shapeless masses. In many places they afford elegant and picturesque compositions, which although passed every day by the crowds who visit Staffa, appear to have been unnoticed. If either their numbers, extent, or picturesque appearance be considered, they are more deserving of admiration than even those of the Giant's Causeway, and had they been the only basaltic columns on this coast, they might have acquired the fame which they merit. But Ulva is eclipsed by the superior lustre of Staffa, and while the mass of mankind is content to follow the individual who first led the way, its beauties will probably be still consigned to neglect.

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* See the Map of Mull.

The islands of Colonsa and Eorsa resemble so nearly in aspect and composition the neighbouring parts of Ulva and Mull, that it is unnecessary to bestow many words on them. It is always however proper to examine these and similar detached spots, since they frequently contain a clue to the explanation of the neighbouring more extensive tracts. In the multiplication of precipitous shores, and in the prolongation of inclined strata, the geologist will often find the key of an enigma which he may have laboured in vain to solve amidst the extensive or mountainous surfaces of a wider region.

Colonsa may be considered a portion of the proximate shores of Ulva, in the same manner as this island is intimately related to the neighbouring parts of Mull. It is not high, is of small extent, and is formed of the same beds of rudely columnar trap and amygdaloid.

Eorsa occupies the entrance of Loch na Keal, and rises to the south-west with a bold and decided aspect.

It contains, as far as I could perceive, but one variety of amorphous trap, disposed, as is the universal rule along this coast, in irregular terraces.

All these islands, as well as the numerous and nameless rocks that skirt these shores, are covered with verdure, and tenanted by sheep or black cattle: even the rock which can maintain but one lamb is not unoccupied.

Having, in the account of Sky, made some remarks on the transitions of nadelstein into quartz, it will not be superfluous here to notice a similar transition between analcime and that substance. The analcime of Ulva however resembles that of Sky and of Mull, and rarely presents any decided transitions of this nature. Where they do occur, they are easily discovered by the different action which acids exert on the several varieties; and the variations of character not unfrequent in this mineral, will be found, on a more complete analysis, to depend on the various proportions of silica in its composition. The most remarkable examples of these varieties occur in the Kilpatrick hills in Dumbartonshire. Here, as I shall have occasion hereafter to describe more particularly, the analcime passes into prehnite. At the same time it passes by an uninterrupted transition into quartz; the crystal of the one substance being sometimes perfect at one side of a specimen, and the other presenting an example of common quartz. In one case in my possession the latter possesses the form of its primitive rhomb. From this it is easy to account for the differences above mentioned which analcime presents when exposed to the action of acids, and for the different proportions of the several earths which it is found to yield on analysis. Hence also the differences of fracture which it displays, and the impossibility, in many cases, of procuring a definite fragment. It is an important circumstance to remark, that throughout this great range of composition, the crystals continue to maintain the same form; a fact however which corresponds with others of an analogous nature occurring in the case of other crystallized compounds. The difficulties which such facts present to a system of mineralogical distinctions founded on geometrical characters, are too well known to be here enforced; as the fragment of analcime cannot be distinguished in some cases from that of quartz, even when the form of the crystal is perfect.

It is among these transitions that a botryoidal substance is found, which, when of a flesh colour, has been called sarcolite. This mineral is not however necessarily of that colour, being sometimes white, while it is occasionally also of a strong red. In the latter case it can sometimes scarcely be distinguished from chert but by its transition and connexions; the red colouring matter abounding so as to destroy the lustre and transparency. This variety also occasionally passes into pure quartz, still maintaining the red colour. I may add to these varieties of analcime, that in the same situations, it is occasionally found crystallized, and of a bright and strong red colour.

THE TRESHINISH ISLES.*

The aspect of these islands from a distance is so singular and enticing, and they are in general so difficult of access, that they offer a double incitement to the curiosity of a traveller, who in visiting Staffa seldom fails to cast a look of regret on that which he can rarely find time or weather to reach. It will tender, to the geologist at least, a service, to inform him that they contain nothing to gratify his curiosity or reward his trouble; since it will both prevent his regrets and teach him to husband his time for better purposes. Had they not been here described, he would perhaps have imagined that they contained neglected treasures; had I not visited them, they would still, like other unattained objects, have haunted my remembrance as they had long done.

The Treshinish isles are disposed in a ridge extending for five miles in a north-easterly direction, and in some degree forming a breakwater toward the north-west for the island of Staffa and the bay of Loch Tua in Mull. There are four principal islands besides some intervening rocks; Cairnburg, which indeed forms two distinct islands, Fladda, Linga, and Bach. They appertain to the farm of Treshinish in Coll, but are uninhabited; and being covered with rich grass, are used for pasturing black cattle. They are all surrounded, with little exception, by perpendicular cliffs, reaching from twenty to forty feet in height or upwards; and are remarkable for the correspondence of their general appearance with each other and with the neighbouring islands.

Cairnburg is divided, as I have said, by a very narrow strait, into two islands, Cairnburg beg, and Cairnburg more; the little and great. The Scandinavian origin of the term burg as applied to a hill fort, may give antiquaries reason to suppose that this was originally one of the strengths of the Danish or Norwegian invaders. It is supposed to have once formed the limit of the Sudereys, or southern islands, which included Man; and to have been their advanced post: historical record indeed proves that it was in the possession of the Norwegians in 1249. The present remains are however of more recent origin, and seem to have been works constructed by the Macleans; under whom they for some time resisted a detachment of Cromwell's army, but were at length taken and burnt. In this siege many of the books and records that had been rescued from Iona at the time of its suppression, and deposited here as in a place of safety, were destroyed; those which escaped this second attack being afterwards dispersed and lost. The modern date as well as the purpose of these buildings are indicated by their construction; they appear to have been mounted with ordnance; as one of the principal works remaining, is part of a wall with embrasures, skirting the edge of the cliff on Cairnburg more. The barrack on the smaller island is still tolerably entire. The appearance of a modern battery in such a situation may well puzzle an antiquary who is unaware of its recent history, and whose ideas ascend to the times of Hacho, or perhaps of Fingal: a modern engineer will only wonder at the choice of such a position for a fortress. However striking the appearance of these remains, when seen from a distance, may be, insulated as they are on a solitary rock in this remote and boisterous sea, their historical dignity vanishes on a near inspection. The idea of gunpowder puts to flight all the visions of antiquity; and whatever sentiments may hereafter be excited by the solid bastion and the "arrowy ravelin," they are at present too familiar and too much associated with a different class of feelings to interest the imagination. A few centuries may perhaps confer that dignity on these ruins, which we can at present see only in the still more insignificant remains of the Danes or ancient Gaël; and when the obscurity produced by distance of time shall resemble that which arises from distance of place, they may acquire that consequence in the eyes of posterity which they now possess in the blue and fading horizon. He who would enjoy the pleasures of the imagination must not scrutinize; let him avoid the shores of Cairnburg.

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* See the Map of Mull.

Fladda presents one uniform flat and uninteresting surface, while Linga rises by a succession of terraces into a hill which appears to be about 300 feet in height. This occupies but a small portion of the island, the remainder of it being, like the former, level and low. Bach is the most remarkable of the chain, being distinguished by a hill which in some positions has the appearance of a hemisphere; from which the whole island acquires the semblance of an ancient shield with the *umbo* protuberant in the centre. It seems to equal Linga in height.

The geological history of these islands is comprised in a few words. They are all formed of trap rocks. The uppermost bed, where two are visible, consists of basalt, having a perpendicular fracture but no columnar forms. The second is an amygdaloid containing indifferent specimens of mesotype and analcime; and where, as in some places, a still lower bed is accessible, it is a repetition of the upper basalt. In these respects, as well as in their general characters, they entirely resemble the neighbouring parts of Mull, Ulva, and Gometra, of which they may in a geological sense be considered as detached portions.

END OF THE FIRST VOLUME.

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